

The Commercialization of Innovative Engineering Ideas

A Strategic Approach for Commercialization of Industry-Sponsored Entrepreneurial Projects at the
University of Saskatchewan, College of Engineering

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Abstract

In this thesis, a commercialization model is developed to facilitate the transition of innovative engineering ideas from industry to the marketplace using the resources of the University of Saskatchewan (U of S), College of Engineering. The commercialization model is proposed to engage the College of Engineering through the Engineering Entrepreneurship Center (a business incubator) and tested for feasible implementation through an illustrative case study with stakeholders.

Recently, universities around the world have been evolving to include a ‘third role’ and embrace entrepreneurship in addition to their traditional roles of research and education. The U of S, College of Engineering has demonstrated ability to be entrepreneurial and to create sustainable spin out businesses. However, many of the businesses created in the College of Engineering were developed in an environment lacking in entrepreneurial culture or support. No explicit model exists in the College to support entrepreneurship or the development of new businesses and thus there is a need to research the potential for a commercialization model to support new business development in the College of Engineering.

In this thesis, a literature review was conducted to identify areas that are critical for the commercialization of industry-sourced engineering ideas in the university environment. The research identified several areas that are important for this commercialization including: collaborations with academics with incentives and mechanisms for participation, management of faculty conflicts, use of laboratory facilities, community engagement including support and education, entrepreneurial financing, effective IP management with the university (ownership, transparent policies, and flexibility), a commercialization process, and management of industry-academic working relationship. A commercialization model was developed that includes these areas of practice in a five-stage process including: idea generation, preliminary feasibility, full feasibility, business planning, and business start-up. The result of the commercialization model developed is a five-stage process that facilitates industry sourced entrepreneurial ideas to the marketplace from the university environment.

This thesis proposes the implementation of the commercialization model through the structure of a privately owned and for-profit business incubator identified as the Engineering

Entrepreneurship Center (EEC). Literature suggests that the for-profit privately owned structure for the business incubator is the most effective structure for the creation of new businesses as opposed to traditional university or non-profit. The EEC is a virtual business incubator that offers services in finance, management, and operations to incubatees in a controlled environment. The EEC also proposes to engage several resources from the local community including: academics along with courses and programs, laboratory facilities, public and private entrepreneurial financing, networks to entrepreneurial financiers, entrepreneurial mentors, an industry specialist, entrepreneurial educational workshops, other entrepreneurial organizations from the surrounding community, and entrepreneurial networking events. Together, the proposed EEC is a virtual and privately operated for-profit business that uses resources of the College of Engineering and surrounding community to operate the commercialization model for the creation of new businesses.

An illustrative case study was conducted in this thesis to demonstrate feasibility of the EEC to support the creation of a new business, Eneray Sustainable Structures. This Eneray case study illustrated feasible steps for the business to engage the commercialization model, the EEC, and the College of Engineering for the creation of the new business. The Eneray case study was also extrapolated to help forecast the financial sustainability of the EEC. The financial forecasts included equity investments in the incubatee businesses as well as small service fees for the incubatees and other typical business expenses. The EEC was projected to become a profitable business in year seven and steadily see increased profitability through incubatee equity investment revenues. The EEC requires an initial investment of \$2.3 million to remain cash positive and is expected to produce an IRR of 21 percent over a fifteen-year projection.

As an indication of the feasibility to successfully implement the EEC and the commercialization model at the U of S, College of Engineering, conceptual participant stakeholders are tested for their willingness to participate. The stakeholder's willingness to participate is an indication of value and feasible implementation of the EEC. Seventeen stakeholders were identified for the illustrative case study including: students, an engineering faculty member, the Dean of Engineering, an entrepreneurial mentor, an industry expert, a law faculty member, an industrial liaisons representative, government financiers, an entrepreneurial financier, a private VC type financier, an industry entrepreneur, and a prospective EEC advisor. Only two of the stakeholders

(government financiers and law faculty member) indicated that they would not participate in the capacity described in the case study. The law faculty member was not able to participate and assist with legal work as law faculty are typically not insured to practice law. As well, the government financiers would not financially sponsor a for-profit business such as the current EEC structure. Alternative avenues of outsourced legal work and other sources of financing are feasible through alternative avenues. In addition, IP management with the ILO and U of S does seem to limit the ability of the EEC and discourages participation for some stakeholders.

Although implementation of the EEC and commercialization model is currently feasible with the current IP management policies at the U of S, there certainly seem to be room for improvement and encouraged participation from several stakeholders. All other stakeholders indicated their willingness to participate resulting in a seemingly feasible implementation of the commercialization model through the EEC. The willing participation given by the majority of the stakeholders is a clear indication that significant value is inherently involved in a concept of the EEC through projects such as the Eneray case study. In other words, as the vast majority of the stakeholders conceptually agree to participate and alternative avenues are available to substitute participation of the two unwilling stakeholders, the EEC and commercialization model demonstrates feasibility.

During the case study the stakeholders were also given the opportunity to give additional feedback and identify strengths, weaknesses, opportunities, and threats for the proposed EEC and commercialization model. Several recommendations for future implementation of the EEC are taken from the stakeholders and include:

- i. specific incentives for academic participation;
- ii. a new academic program related to the EEC;
- iii. a potential sources of financing through a private firm;
- iv. the use of share options instead of equity positions for entrepreneurial participants;
- v. research to complete a competitive space map for the EEC;
- vi. entrepreneurial presentations to support idea generation;
- vii. employee share ownership for the EEC staff;
- viii. more management throughout commercialization regarding the industry entrepreneur's participation;

- ix. further investigation regarding university policies regarding IP for industry sponsored projects; and
- x. more support throughout commercialization for business valuation.

These recommendations are all feasible to be minor additions to the EEC and commercialization model developed in this thesis.

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List of Abbreviations

ILO – Industrial Liaisons Office

ROI – Return On Investment

EEO – Engineering Entrepreneurship Option

NRC – National Research Council

NSERC – National Sciences and Engineering Research Council

IRAP – Industrial Research Assistance Program

SAINT – Saskatchewan Angel Investor Network

SBIR – Small Business Innovation Research

IP – Intellectual Property

SGM – Stage Gate Model

COC – Conflict of Commitment

COI – Conflict of Interest

NVT – New Venture Template

EEC – Engineering Entrepreneurship Centre

NBIA – National Business Incubation Association

HPFRC – High Performance Fibre Reinforced Concrete

NPV – Net Present Value

VC – Venture Capital

IRR – Internal Rate of Return

SWOT – Strengths, Weaknesses, Opportunities, Threats

MOU – Memorandum of Understanding

MOA – Memorandum of Agreement

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1.0 Introduction

The primary purpose of this thesis is to determine if there is a strategy that can help engage the University of Saskatchewan (U of S) and the College of Engineering to realize the value of commercialization through the facilitation of industry-sponsored entrepreneurial projects. If such a strategy exists, a second focus of this thesis will be to test the strategy for its potential to be implemented with relevant stakeholders. To realize the current potential, it is first important to understand the local entrepreneurial environment and culture as well as the opportunities that research universities have to participate in entrepreneurship. Background of the local U of S entrepreneurial environment as well as opportunities for universities to participate in entrepreneurship is discussed in the following sections 1.1 and 1.2.

1.1 Entrepreneurship at the U of S and College of Engineering

The U of S and surrounding local economy have demonstrated the capability and willingness to adopt an entrepreneurial culture. Initiatives are being taken at the U of S for an evolutionary movement to engage entrepreneurship as evidenced by initiatives including: the introduction of the W. Brett Wilson Center of Entrepreneurial Excellence, the Engineering Entrepreneurship Option (EEO), and various strategic organizational changes within the Industrial Liaison Office (ILO) such as the recent addition of an Engineering Technology Transfer Officer and an Entrepreneur in Residence. The W. Brett Wilson Center supports excellence in entrepreneurship through networking several colleges at the U of S. The EEO is an optional addition to a Bachelor of Engineering degree that incorporates business coursework focusing on entrepreneurial skills. The ILO facilitates the University's interests in commercializing technologies and managing patents. Together these initiatives represent a progressive movement towards an entrepreneurial culture at the U of S.¹

Organizations from within the surrounding U of S community also play a key role in supporting entrepreneurial culture and technology commercialization. Government organizations such as the National Science and Engineering Research Council (NSERC), Industrial Research Assistance

¹ There is no measure apparent to the author of this thesis regarding the net benefit of these initiatives; however, they're an indication of increased activity in entrepreneurship at the U of S.

Program (IRAP), and MITACS² have shown interest in financing university research projects with commercial potential. Other organizations such as Enterprise Saskatchewan, Innovations Saskatchewan, Saskatchewan's Angel Investor Network (SAINT), and Springboard West also have initiatives to support commercialization. These initiatives represent an environment and culture external to the U of S that supports entrepreneurship.

Despite the initiatives currently in place, a commercialization strategy developed with a specific focus for the College of Engineering could have a differentiated advantage if built upon its existing and unique resources. This strategic advantage is gained from:

- engineering students;
- faculty and their individual professional networks; and
- highly specialized lab space and testing facilities.

Many of the College of Engineering faculty have realized the potential of these resources through the creation of several businesses. The College of Engineering has seen spin-out companies such as Vecima Networks Inc, International Road Dynamics Inc (IRD), MDH Engineered Solutions, Geo-Slope, Vemax Management Inc, Pavement Scientific International, and Startco within the past few decades. Vecima Networks and IRD are public companies and have easily accessible corporate information. Together Vecima and IRD account for over 1000 jobs (approximately 75% locally employed) with combined annual revenues estimated at \$150 million. The success of these spin-out businesses demonstrates the potential value within the College of Engineering and its ability to produce knowledge-driven economic value through research innovations.

However, the resources of the College of Engineering have never been strategically organized to facilitate commercialization for the creation of new businesses. Anecdotal evidence suggests many of these spin-out businesses have developed in an environment lacking an entrepreneurial culture and have stories of hardship and lack of support in their development years. The College of Engineering demonstrates good potential to create new businesses but no such model exists to facilitate the process.

² MITACS is not an acronym but is the name of a Canadian government program described later in Chapter 3.

1.2 Entrepreneurship and University Involvement

Entrepreneurship is considered by many to be a critical component of a sustainable economy (Baumol, Litan, & Carl, 2007) and several researchers have placed entrepreneurs in the same ranks as the three classical agents of economics – land, capital and labour (D'Cruz & O'Neal, 2003). The creation of new technology businesses has been noted to support economic growth through business renewal and job creation as well as the ability of technology to increase productivity. Many economists regard employment rates as a significant indicator for the health of an economy and entrepreneurship is responsible for a large portion of job creation. Recent studies show one-third of total job creation in the U.S. is attributed to entrepreneurship (Davis, Haltiwanger, & Jarmin, 2008). This job creation is spread across the spectrum of industries but technology related jobs are assumed to be significant contributors. Entrepreneurs also develop and apply innovative technologies that address industry problems and drive productivity. The nature of technology is the application of science to a set of defined inputs resulting in increased productivity towards the desired outputs. Industry giants such as General Electric rely on purchasing new entrepreneurial driven technologies to increase their firm's productivity and remain competitive within the global economy (Hornsby & Kuratko, 2009). Entrepreneurship contributes to the economy by being both: (i) a critical part of the business renewal processes that define market economies; and (ii) an effective driver of productivity through applying innovative technologies to industry problems (Hornsby & Kuratko, 2009).³

Recent decades have experienced a significant growth in initiatives and services that strategically support new business creation and entrepreneurs. Dilts and Hackett attribute the increased support for entrepreneurial activity in the U.S. to: “(i) the passage of the Bayh-Dole Act in the U.S. Congress in 1980 decreased the uncertainty associated with commercializing the fruits of federally funded basic research, (ii) the U.S. legal system increasingly recognized the importance of innovation and intellectual property rights protection, and (iii) profit opportunities derived from the commercialization of biomedical research expanded” (Dilts & Hackett, 2004). In more recent times a global growth in business incubation and entrepreneurial assisted activity has

³ This thesis does acknowledge that entrepreneurial subsidies do often play a role in supporting entrepreneurship and increasing the economic benefit; however, this thesis does not consider the economic benefit of entrepreneurship if these subsidies were absent or whether these subsidies are actually effective to create net value.

occurred (Ryker, 2001). Since 1980, business incubation organizations have increased in numbers from 15 to 1100 in North America demonstrating the demand to support increased entrepreneurial activity (National Business Incubation Association, 2006). Approximately 20 percent of these business incubators work in direct collaboration with research universities (Knopp, 2008).

Research universities have the ability to strategically use their resources to facilitate commercial opportunities and to contribute to new business creation within the context of the knowledge economy. A knowledge driven economy presumes that knowledge is the value that leads to a strategic competitive advantage between firms and organizations. Research conducted by Coopers and Lybrand L.L.P. conclude that businesses with university affiliation have productivity rates almost two-thirds higher than their peers largely due to using student and faculty resources (O'Neal, 2005). Governments realize research universities are one of the largest sources of knowledge creation and thus have the ability to stimulate the economy. As a result, governments are introducing and encouraging funding programs to promote research with practical applications through student scholarships, tax rebates and subsidies, specialized new business grants, and research grants. With access to government assisted funding and high sources of knowledge, research universities can help stimulate the economy through initiatives to support entrepreneurship.

Due to the influences of a knowledge driven economy, the role of universities has evolved over the last few decades to add entrepreneurship as a 'third role' in addition to the classical roles of research and education. Some academics describe the 'third role' as increased interaction between universities and firms of the region and thus the transformation into economic engines (Viljamaa & Srinivas, 2008). Through the integration of the 'third role', research universities have become major contributors to economic growth and several Canadian engineering governing associations have noted the importance of embracing such practices. Five of eight recommendations in The Role of Engineering in Building a National Strategy in Science and Technology in Canada, jointly written by four well respected governing associations of engineering in Canada, directly reflect the necessity of government and university involvement towards innovative technology commercialization and entrepreneurship (The Canadian Academy of Engineering, The Canadian Council of Professional Engineers, The Association of Consulting

Engineers of Canada, The Engineering Institute of Canada, 1994). To remain globally competitive in a knowledge driven economy, universities are increasingly pushed to adopt the 'third role' and be contributors to the economy.

University adoption of the 'third role' and practices for technology commercialization can greatly stimulate the local economy as well as increase the welfare of the university. Massachusetts Institute of Technology (MIT) demonstrates the economic potential of the 'third role' as alumni have produced 25,800 currently active companies that employ 3.3 million people and generate \$2 trillion in annual world sales - equivalent revenues to the world's eleventh largest economy (Roberts & Eesley, 2009). Approximately 60 percent of these alumni companies are located in the MIT area. MIT is among the most successful in the commercialization of research technologies but several other universities (Georgia Institute of Technology, California Technology Institute, and University of California, for example) also demonstrate the ability for research institutions to produce new businesses that drive their economies. Researchers have concluded that policies and initiatives in the university environment are effective mechanisms to promote university commercialization (Rasmussen, Moen, & Gulbrandsen, 2006). Research universities can clearly become local economic drivers with the appropriate adoption of policies and practices to facilitate the 'third role'.

University adoption of the 'third role' also has the potential to add value for student education, industry-academic collaborations, and faculty research opportunities. Value can be captured in the form of higher education for students. Business incubation can be a natural extension of engineering schools, and proper facilitation can provide an ideal environment for students to receive real world experience and applied education with less dependence on internal funding (Cook, 1996). The strategic implementation of practice to facilitate commercialization can capture value for universities and industry entrepreneurs. Through the success of new businesses, all stakeholders including the university and the innovators involved can capture reputation-value. Targeting industry-sponsored projects to be commercialized with university resources can also encourage new innovative real-world research opportunities for faculty. In turn, faculty will have an additional source of research opportunities available. As a result of the value captured by the stakeholders in the university adoption of the 'third role', a study in 2007 of three major research universities concluded each entity "has become the major force of development in

technology, generation of talent, and the creation of jobs and wealth within their regions” (Raymond, Niall, Gregory, & Robert, 2007).

Collectively, the current local organizational environment, global university trends, and available resources suggest a strong potential for a commercialization strategy within the College of Engineering to facilitate the transfer of research to the marketplace through the creation of new businesses. The success of spin-off businesses from within the College of Engineering demonstrates an ability to create commercial value. It is hypothesized that the strategic alignment of university resources within a commercialization model that supports entrepreneurial policies, as well as initiatives to facilitate entrepreneurial business development, can help magnify the value of commercial opportunities. No explicit strategy or process has been implemented to support commercialization within the U of S College of Engineering and therefore a need exists to research potential strategies to facilitate the creation of new businesses through a commercialization model. The College of Engineering resources, in collaboration with other entrepreneurial organizations, may provide strategic advantages for a commercialization model resulting in significant value potential.

1.4 Objectives

The primary goal of the thesis is to develop a commercialization model with likely potential to engage and gain cooperative participation from necessary stakeholders in order to facilitate the transition of innovative engineering ideas from industry to the marketplace using the resources of the University of Saskatchewan, College of Engineering.

The first objective is to develop a commercialization model that can facilitate the transition of innovative engineering ideas from industry entrepreneurs to the marketplace in the university environment. The aim is to identify and strategically coordinate important practices for university commercialization and business development within a generic university commercialization model.

The second objective is to develop a strategy to implement the commercialization model within the U of S, College of Engineering. The aim is to engage the commercialization model with the resources of the College of Engineering as well as collaborative efforts from the surrounding community.

The third objective is to test the feasibility of the commercialization model to be implemented with the College of Engineering as well as to gain cooperative participation from the stakeholders. The aim is to determine if the commercialization model, as implemented with the College of Engineering, produces perceived value for the individuals involved in the process.

1.5 Scope

Research in this thesis is focused on the development of a commercialization model that will engage innovative business ideas at the U of S, College of Engineering. These business ideas will be limited by discipline, source of invention, and stage of development. The commercialization model will focus on business ideas that are:

- i. at the very early stage of commercialization;
- ii. from the engineering discipline; and
- iii. inventions discovered by industry sources and subsequently brought to the College of Engineering.

The commercialization model will focus on business ideas in very early stage and conceptual phase. The business ideas will be limited to the engineering discipline and specifically those that have the potential to obtain value through engineering R&D. The sources of the ideas will also be limited to those that are brought to the College of Engineering from industry. For this reason, intellectual property (IP) for faculty inventions will not be a central focus; however, ownership of IP within the context of industry-sponsored research collaborations will be a significant focus. Although this research scope does limit the commercialization model for a specific area of commercial opportunities, future work may adapt the model to a broader scope to include several other innovative pathways including faculty originated ideas and ideas from other disciplines.

The commercialization model will need to engage certain areas of practice to effectively support new business creation in the university environment. The areas of research that will be included in the commercialization model will be limited to the successful practices for both university commercialization as well as early stage business development. The model will not attempt to develop any new practices within these business areas; however, the integration of practices for the commercialization model specific to the U of S, College of Engineering will be new. The

integration of practices within these areas will ideally result in a comprehensive and effective commercialization model specific for a university environment.

A focus of the implementation strategy will be to engage the College of Engineering strategic resources as well as collaborative partnerships from the surrounding community. To operationally interface the commercialization model with the College of Engineering, the commercialization model will be implemented through a business incubator. The business incubator will be structured for:

- business model, mission, and objectives;
- individuals and resources necessary for business operations including staff and advisors; and
- services and resources that will be offered to support operations.

Specific attention will be given within the implementation strategy to engage the resources of the College of Engineering including the students, faculty, and laboratory facilities. In addition, the implementation strategy will include the potential for collaborative partnerships with entrepreneurial initiatives of the surrounding environment that may include Ideas Inc, Springboard West, the ILO, the W. Brett Wilson Center, and the NRC. Together, the College of Engineering strategic resources and entrepreneurial initiatives of the surrounding community will aim to provide the business incubator support to operate the commercialization model.

A case study application will be used to demonstrate the commercialization model to the stakeholders. The stakeholders are the individuals necessary for the effective operation of the commercialization model at the College of Engineering and this is limited to: industry-entrepreneurs, students and faculty as academics involved in commercialization, an ILO representative, individuals to operate the business incubator, outside entrepreneurial individuals that directly support the commercialization project, entrepreneurial financiers, the Dean of Engineering, and potential financiers of the business incubator. The stakeholders will provide feedback regarding the implementation of the commercialization model at the College of Engineering and indicate: opportunities for improvement, potential barriers of operations, strengths, weaknesses, and their willingness to cooperatively participate. The stakeholders will

indicate the feasibility of the commercialization model to successfully engage the College of Engineering and possible recommendations for future improvements.

1.6 Methodology

1.6.1 Conceptual Methodology

The goal of the thesis is to develop a commercialization model that can engage the College of Engineering and surrounding resources to assist industry entrepreneurs for the creation of new businesses. The steps involved to accomplish this are:

- i. identify the important areas of success for commercialization in the university environment and for new business development;
- ii. identify effective practices within these areas of success;
- iii. develop a generic university commercialization model based upon the effective practices for university commercialization and new business development;
- iv. develop an organizational structure for a business incubator to implement the commercialization model around the College of Engineering;
- v. identify the specific resources from the College of Engineering and the surrounding environment that are available to support the operation of the commercialization model through the business incubator;
- vi. complete an illustrative case study with an industry entrepreneur as a working example of the implemented commercialization model; and
- vii. test the feasibility of the commercialization model to be implemented at the College of Engineering using feedback from the stakeholders that are conceptually involved in the case study.

1.6.2 Detailed Methodology

The first part of this thesis is research to identify the successful practices to be included in the commercialization model. A literature review will be conducted to determine the areas of success for university commercialization as well as new business development. Some of the areas of successful practice are included in the following list.

- i. *Commercialization Process with Management*
- ii. *Networks and Community Involvement*

- iii. *Intellectual Property Policies*
- iv. *Participation of Academic Individuals and Laboratory Facilities*
- v. *Entrepreneurial Finances*

Further research within the literature review will be conducted to identify the effective practices within these areas of success. To confirm the practicality of the identified practices, an industry overview of select universities will be conducted to confirm if the practices are effective to create new businesses in practice. These successful practices will then be assembled into a generic commercialization model for the creation of new businesses in the university environment. The intended result of the integrated practices is not to develop the one best commercialization model of its kind but instead is to be an appropriate and feasible commercialization model for the current U of S, College of Engineering. The commercialization model developed in this thesis may be viewed as a starting point to be incrementally improved in future work.

The strategy for implementation will aim to interface the commercialization model with the College of Engineering and engage its resources as well as the surrounding entrepreneurial initiatives through the use of a business incubator. Steps to develop the implementation strategy are to:

- i. define a structure for the business incubator;
- ii. describe how the resources of the College of Engineering will support the commercialization model; and
- iii. identify the initiatives from the surrounding community can cooperatively participate and share value.

The implementation strategy will first define the structure of the business incubator. The structure will build on industry-proven successful practices to support new business creation. Next, the implementation strategy will engage the potential strategic resources of the College of Engineering to act as support services to the commercialization model. This will include involvement of students and faculty as well as access to laboratory facilities and equipment. Finally, initiatives that support entrepreneurship within the U of S and surrounding community will be identified for their potential to participate. The strategy will describe a method to cooperatively participate with the entrepreneurial initiatives of the surrounding community and

not in competition. For a clear representation, a description of the commercialization model implemented at the College of Engineering will be summarized within a flowchart illustration. A successful strategy will be structured to facilitate the creation of new businesses by engaging the College of Engineering and the surrounding community.

The feasible operation of the commercialization model will be tested through indications of the ability and incentives for the stakeholders to participate, these assessed through feedback regarding operational barriers within the model as well as the stakeholder's willingness to participate. A case study will be presented to the stakeholders for a clear illustration of their conceptual involvement with the commercialization model. The case study will be with industry entrepreneur, Eneray Sustainable Structures, for the development of an innovative engineering idea within the context of the commercialization model. Eneray has a business idea for a regionally-produced high fibre concrete with potential for various infrastructure applications. The business idea requires research and development in both technical and business areas. The case study will aim to use the commercialization model with the College of Engineering to assist Eneray in realizing the full market potential of their innovation.⁴ The stakeholders will subsequently be given a summary presentation of this case study and asked for feedback within a brief SWOT (Strength-Weaknesses-Opportunity-Threats) analysis in addition to indicating their willingness to participate. The feedback collected from the stakeholders will be used to assess the feasibility of operating the commercialization model through the implementation strategy as well as potentially lead to recommendation for future incremental improvements.

⁴ An important component of the case study will be to forecast ROI for the stakeholders - as this will likely be a major motivation regarding incentives for their participation. ROI for entrepreneurial ventures can sometimes take five years or longer to realize and this is much longer than the length of this project. Thus, due to time constraints, financial forecasts will be used base on reasonable assumptions to estimate the ROI for the stakeholders.

2.0 University Commercialization with Industry Entrepreneurs

This thesis researches a commercialization model to support industry entrepreneurs in creating businesses using the resources of the U of S, College of Engineering. To develop an effective commercialization model it would seem reasonable to include: (i) the factors that are important for early stage business development; and (ii) factors that are important to promote commercialization activities in the university environment. Business incubators are considered by some academics as a common mechanism of technology transfer at universities (Phillips, 2002) and in essence are organizational support mechanisms for the growth of early stage business ventures. In this regard, it would seem reasonable to use a business incubator's factors for success in an effort to identify the significant factors for early stage business development. In addition, as the commercialization model has a focus for the university environment, it is also important to identify the factors from within universities that are important for commercialization.

The following chapter will review literature and industry practices with the aim to identify successful practices for university commercialization and new business creation. The literature review will:

- establish a definition and understanding of various business incubator structures;
- identify the important areas for industry-sponsored university commercialization; and
- identify successful practices that can be employed to address the important areas for commercialization.

The identified practices will be reviewed across six universities with a proven ability to create new businesses in order to understand some successful industry practices. Chapter 2 will give an understanding of the theoretical and applied practices that are important for university commercialization with industry entrepreneurs and help build the foundation for the commercialization model to follow.

2.1 The Definition of a Business Incubator

There is much ambiguity surrounding the definition of a business incubator and in effort to identify the important factors for early stage business development it is first necessary to establish a clear definition of a business incubator. There is no one-standing definition of a business incubator and this may be due to the difficulty in defining a word that represents a wide variety of practices. Hackett and Dilts (2004), who completed a systematic review of business incubation research, note four significant areas of definitional ambiguity for business incubators including:

- i. adaptation of the business incubator term to fit several scenarios;
- ii. interchangeable use of research parks, technology innovation centers, and business incubation;
- iii. no clear definition for virtual incubators; and
- iv. no clear definition concerning the business incubation process.

To avoid this ambiguity, certain scholars and professional associations offer similar definitions that can be drawn on to develop a definition for this thesis. The European Business Incubation Association and The National Business Incubation Association of America agree that a business incubator will provide finances, operational and management assistance, and facilities to assist businesses (Ryker, 2001). Hackett and Dilts offer a similar definition as “a shared office space facility that seeks to provide its incubatees with strategic, value added intervention system of monitoring and business assistance” and additionally acknowledge that a business incubator is more than infrastructure and facility but is also a network of individuals and organizations (Dilts & Hackett, 2004). Ryker (2001) uses a definition that encompasses a controlled space instead of shared office space or facilities to include the possibility of a virtual incubator that has no shared space but offers all other services in a controlled virtual environment. For the purpose of this thesis, a business incubator will be defined as business services in finance, management, and operations that are offered to an incubatee from surrounding individuals and organizations in a controlled environment.

2.2 The History and Taxonomy of Business Incubators

The United States were the early adopters of business incubators in the 1960's and 1970's including what many consider the first business incubator, the “Butavia Industrial Center” in

1959 (National Business Incubation Association, 2009). Many of these first incubators were associated with government programs and universities (Ryker, 2001). Dilts and Hackett reported that in 1980 a significant growth occurred for business incubators in the US for reasons that include (i) changes to US legislation and (ii) the evolution of the Biotech industry as previously discussed in Chapter 1 (Dilts & Hackett, 2004). More recently, business incubation has significantly increased around many other countries of the world including Canada (Ryker, 2001). Business incubation has grown over the last fifty years to be commonplace in centers of innovation taking form with many distinctive business incubator structures.

One of the first academic efforts to subdivide business incubator structures was to make a distinction between real estate business incubators that add value through low rents and business development incubators that attempt to add value through job creation (Ryker, 2001). Further research divided incubators into four categories defined by the value added and objectives of the incubators as illustrated in Figure 1 and reproduced from its original author Allen and McCluskey and published by Dilts & Hackett (Dilts & Hackett, 2004).

	Real Estate For-Profit Property Development Incubators	Value-Added Through Non-Profit Development Corporation Incubators	Business Development Academic Incubators	For-Profit Seed Capital Incubators
PRIMARY OBJECTIVE	Real estate appreciation Sell proprietary services to tenant	Job creation Positive statement of entrepreneurial potential	Faculty-Industry collaboration Commercialize university research	Capitalize investment opportunity
SECONDARY OBJECTIVE	Create opportunity for technology transfer Create investment opportunity	Generate sustainable income for the organization Diversify economic base Bolster tax base Complement existing programs Utilize vacant facilities	Strengthen service and instructional mission Capitalize investment opportunity Create good will between institution and community	Product development

Figure 1: Business Incubator Types by Value Added and Objective

Figure 1 illustrates the distinction between four types of incubators in *For-Profit Property Development Incubators*, *Non-Profit Development Corporation Incubators*, *Academic*

Incubators, and *For-Profit Seed Capital Incubators*.⁵ One interesting distinction to note regarding the categories is the *For-Profit* business incubators have specific objectives to create or capitalize on investment opportunities whereas the *Non-Profit* and *Academic Institution* business incubators are more focused on more qualitative objectives like job creation and faculty-industry collaboration.

In addition to the categories described in Figure 1, Hackett and Dilts draw on several other research studies to further develop a taxonomy of business incubators as illustrated in Figure 2 (Dilts & Hackett, 2004).

Taxonomy	Representative citation
<i>Incubator level: primary financial sponsorship</i> ¹⁴	(Kuratko and LaFollette, 1987; Smilor, 1987b; Temali and Campbell, 1984)
<ul style="list-style-type: none"> • Publicly-sponsored • Nonprofit-sponsored • University-sponsored • Privately-sponsored 	
<i>Incubator level: business focus</i>	(Brooks, 1986)
<ul style="list-style-type: none"> • Property development <ul style="list-style-type: none"> 1. Single tenant 2. Multi-tenant • Business assistance <ul style="list-style-type: none"> 1. Shared space 2. Low rent 3. Business support services 	
<i>Incubatee level: business focus</i>	(Plosila and Allen, 1985; Sherman, 1999)
<ul style="list-style-type: none"> • Product development • Manufacturing • Mixed-use 	
<i>Type of incubatee</i>	(Plosila and Allen, 1985)
<ul style="list-style-type: none"> • Spin-off • Start-up 	

Figure 2: Incubator Taxonomy

The illustration in Figure 2 shows some fundamental differences that may exist between business incubators including:

- the business incubator's primary financial sponsor;
- the number of incubatees;

⁵ There is no reason to conclude that, in practice, a business incubator is limited to these categories and cannot aim for multiple objectives across these categories of Figure 1 but, these categories do help to illustrate some of the common objective among incubator types.

- the business focus of low rents or business development;
- the business focus of the incubatee; and
- the type of business in very early stage university spin-out or later stage business start-up.

These distinctions assist to characterize and define different business incubation structures.

There is little conclusive scholarly research to indicate any one best business incubator structure; however, research of university commercialization has indicated that a for-profit private venture extension to a university is most effective in creating new businesses (Markman, Phan, Balkinc, & Gianiodis, 2005). Markman et al. (2005) research categorizes university commercialization structure into three structure types: *Traditional University Structures*, *Non-Profit Research Foundations*, and *For-Profit Private Venture Extensions*. The research concludes that, although the *For-Profit Private Venture Extensions* are by far the least common of the types, they are the most effective type for creating new businesses.

2.3 Success Factors for University Commercialization with Industry Entrepreneurs

Scholarly discussion surrounding the factors that influence successful university commercialization with business incubators is broad; general areas include: community involvement, incubator operations and services, ideal selection of business incubatee, and university policy (Dilts & Hackett, 2004)(Rasmussen, Moen, & Gulbrandsen, 2006).

Dilts and Hackett, through their review of the incubation industry have summarized scholarly critical success factor from the perspective of the community, business incubator, and the incubatee. The findings of these critical success factors are described in Table 1 and include: community support; entrepreneurial networks; entrepreneurial education; ties to a university; access to finance and in-kind support; selection and monitoring of incubatees; on-site business expertise; milestones with clear policies and procedures, perception of success, and business attractiveness.

Table 1: Important Factors for Business Incubators Success

Success Factors for Business Incubators	Description
Community Support	Support from the initiatives in the community that can both help establish the incubation center and further assist with sustainable existence.
Entrepreneurial Networks	Develop entrepreneurial networks to establish collaborative efforts to support the incubation process.
Entrepreneurial Education	Educate the public and private sectors regarding the incubation programs and opportunities to participate.
Ties to a University	Create a collaborative working relationship with a university.
Access to Finance and In-Kind Support	Facilitate the ability for the business incubatee to access finances.
Selection and Monitoring of Incubatees	Due diligence in appropriate selection of incubatees and monitoring of their progress through incubation process.
On-site Business Expertise	Facilitate on-site business assistance for incubatees.
Milestones with Clear Policies and Procedures	Establish and provide the incubatees with a clear indication of steps and sequences of the commercialization process.
Perception of Success	Both business incubator and incubatee should come to a realistic strategy and vision for success of the business venture.
Business Attractiveness	Attract and select businesses that are appropriate for the incubation program.

In addition to the critical success factor listed in Table 1, any commercialization model that engages a university must consider the university policies that influence commercialization. Moen, Rasmussen, and Gulbrandsen (2006) provide an overview of initiatives and policies for commercialization of university knowledge and are summarized in Table 2.

Table 2: Important Areas Concerning University Commercialization

Factors Influencing University Commercialization	Description
Entrepreneurial Culture	An encouraging environment for commercialization with incentives for academics to participate and ability to receive entrepreneurial education and training.
Excellence in Research	Place a priority in university research excellence.
University Image, Facilities, and Individuals	Universities can support the commercialization of technologies through credibility of the university, laboratory facilities, and academic individuals.
Capital	Participation of financiers in seed capital as well as financing know-how support an environment for new business creation.
Intellectual Property (IP)	Create intellectual property policies to encourage commercialization activity.

Table 2 identifies entrepreneurial culture, excellence in research, university image and resources, capital, and intellectual property as important factors for university commercialization. The previously listed factors influencing university commercialization and business incubator success are re-organized and summarized in Table 3 for further discussions in this thesis. ⁶

Table 3: Critical Areas Influencing Commercialization Surrounding Universities

Success Factors for University Commercialization with Industry Entrepreneurs	Description of the Factors Considered
Participation of Academic Individuals and Laboratory Facilities	Entrepreneurial Education, On-Site Business Expertise, Entrepreneurial Culture, University Individuals and Facilities
Networks and Community Involvement	Community Support, Entrepreneurial Networks, On-site Business Expertise, Entrepreneurial Education
Intellectual Property	Intellectual Property
Entrepreneurial Finances	Access to Finance and In-Kind Support, Capital
Commercialization Process and Management	Selection and Monitoring of Incubatees, Milestones with Clear Policies and Procedures, Business Attractiveness, Perception of Success

⁶ The second column of Table 3 (description of the factors considered) identifies headings that refer back to the first column of Table 1 and 2 (that identifies the success factors) as well as the respective descriptions in second column of Table 1 and 2. No information is lost in the re-organization of Table 3, it is simply re-organized in a higher level summary.

Table 3 is a re-organized summary of the factors influencing university commercialization and business incubator success into new headings of success factors for university commercialization with industry entrepreneurs. The purpose for the re-organization is to structure the discussion to come in sections 2.4 through 2.8 to further elaborate on successful practices within each of the respective areas. All the factors listed in Tables 1 and 2 (apart from the factors discussed in the following paragraph) are included in this re-organization; however, Table 3 uses a more concise five categories in aim for a clear and concise discussion to follow.

A few factors that are left out of Table 3 and future research in this thesis are: *Ties to University*, *Excellence in Research*, and *University Image*. Although *Excellence in Research* and *University Image* have a positive influence on commercialization ability, practices to encourage these are of greater scope than the research focus of commercialization. In addition, *Ties to University* is not explicitly included in further research but is implicitly included in the thesis topic of a university commercialization model.

2.4 Commercialization Process and Management

Several factors crucial to university commercialization and business incubator success are identified in section 2.3 and reflect the need for a strategic commercialization path and accompanied project management tactics within the commercialization model. These success factors include: selection and monitoring, milestones with clear policies and procedures, selecting attractive businesses, and establishing a clear perception and strategy for success. These factors will be discussed further within: (i) a commercialization process that describes the procedures, milestones, and selection method for business ventures; and (ii) a management strategy to monitor the business ventures. The management strategy, in the context of this thesis and industry-sponsored projects, must also consider the industry-academics working relationship as many academics identify an inherent cultural gap that can result in project inefficiencies (Philbin, 2008). The following sections will discuss some practices that have been identified in literature to support an effective commercialization process as well as efficient management practices (including industry-academic working relationships).

2.4.1 Commercialization Process

An enormous amount of work is involved in the launch of an idea to the marketplace. However, a significant amount of this work can often be avoided through strategic planning of the

commercialization process. The commercialization process is often complex and uncertain resulting in misaligned resources and expensive product failures. The beginning stages of the commercialization process is often referred to as the ‘fuzzy front end’ - earning this title as it is unclear whether the idea should be supported going forward (Reinertsen, 1999). Strategic planning at the ‘fuzzy front end’ can provide foresight and reduce the loss of misaligned resources. The Stage Gate Model (SGM) is a template developed by Robert Cooper in 1986 for strategic planning of product development within industry firms to address the ‘fuzzy front end’ (Gresock & Barringer, 2008). Cooper’s SGM consists of a series of five stages and corresponding gates as reproduced in Figure 3 from its publication by Gresock and Barringer (2008).

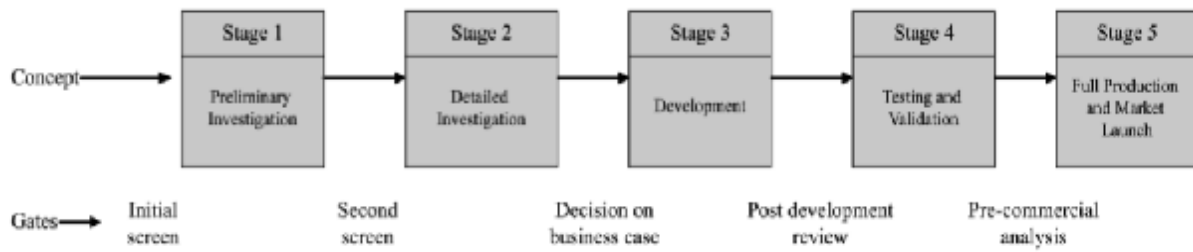


Figure 3: Cooper's Stage Gate Model

The SGM provides a process whereby a concept will sequentially undergo stages in a: quick feasibility assessment of the product idea, detailed and in depth feasibility analysis, design and development of the product, extensive in house testing and validation, and finally product launch to market. After each stage of the SGM, a gate represents a decision to screen the concept or continue to the next stage. Predevelopment management strategies such as the SGM have resulted in a 75 percent success rate for product development compared to a 31.3 percent success rate where these activities were lacking (Cooper, 2003). Within industry firms, the most common form of commercialization planning is the SGM. Today, over 73 percent of firms use the SGM as their predevelopment management strategy (Gresock & Barringer, 2008). Similarities can be drawn between the entrepreneurial commercialization process and new product development in firms. The similarities lead many researchers to note the strong potential for the SGM to be adapted and used by entrepreneurs to coordinate resources and launch an effective path to commercialization (Gresock & Barringer, 2008).

An adapted SGM was completed through research conducted at the University of Central Florida to bridge the gap between product development in the SGM and what is called the Front End Entrepreneurial Process for new venture development (Gresock & Barringer, 2008). The Front End Entrepreneurial Process identified the following modified stages and affiliated gates as reproduced in Figure 4 from its original publication by Gresock and Barringer.

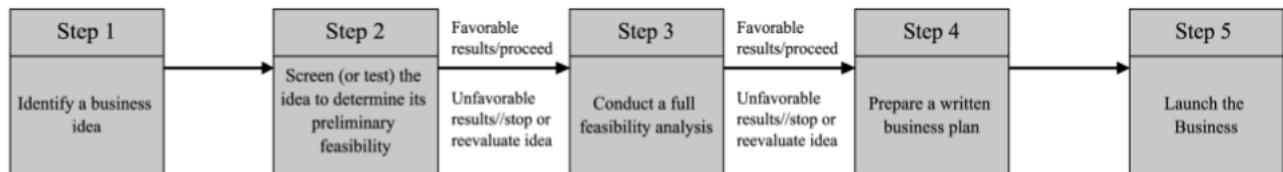


Figure 4: The Front End Entrepreneurial Process

The Front End Entrepreneurial Process uses the same structural process as the SGM but includes different stages to adapt for entrepreneurial ideas and the creation of new businesses. The process illustrated in Figure 4 identifies the stages of: identification of business ideas, screening for preliminary feasibility, full feasibility analysis, preparation of a business plan, and launching the business idea. These stages are discussed in further detail within Chapter 3 and will help structure the commercialization model to be developed in this thesis.

Following the arguments of this section, it is clearly important to have a process with clear policies and milestones within the commercialization process; however, it is also important not to go too far with procedures and create a bureaucratic environment. Too many regulations and procedures result in decisions and new ideas getting lost in a maze of procedural conformity (Chisholm, 2001). This is the type of environment that could restrict creativity and innovation. A balance of procedure with limited bureaucracy would intuitively be ideal for commercialization. The commercialization procedure developed in this thesis should be careful not to add any unnecessary hurdles in effort to limit bureaucracy. As the focus of commercialization discussed in this thesis is for the university environment, university bureaucracy may be burdensome to commercialization. University bureaucracy falls outside of the scope of this thesis, but there may be opportunity to continue work through future research in this area.

2.4.2 Management of Industry-Academic Projects

The management and monitoring of the business ideas, along with a commercialization process, is identified as an important factor for university commercialization (Dilts & Hackett, 2004). An effective management strategy for university commercialization must acknowledge what many academics have identified as a ‘cultural gap’ (Barnes, Pashby, & Gibbons, 2000). The ‘cultural gap’ refers to a disconnect within inter-organizational practices between industry and academia. Best practices to reduce the ‘cultural gap’ will intuitively increase the efficiency of the working relationship and probability that the collaborations will be successful. Philbin (2008) conducted a research study of business people, service staff, and academic faculty and concluded three factors important to industry-academic collaborations are:

- i. process factors for effective project management;
- ii. knowledge factors for communication between groups; and
- iii. social factors to understand the working habits between groups.

Strategizing practices around these factors will help develop an efficient commercialization model for the university environment. The research study of these factors followed to develop a ‘process model’ to incorporate knowledge, social, and process factors within the industry-academic collaborations.

The ‘process model’ uses a staged framework that includes: terrain mapping, proposition, initiation, delivery, and evaluation, as shown in the Figure 5 below.

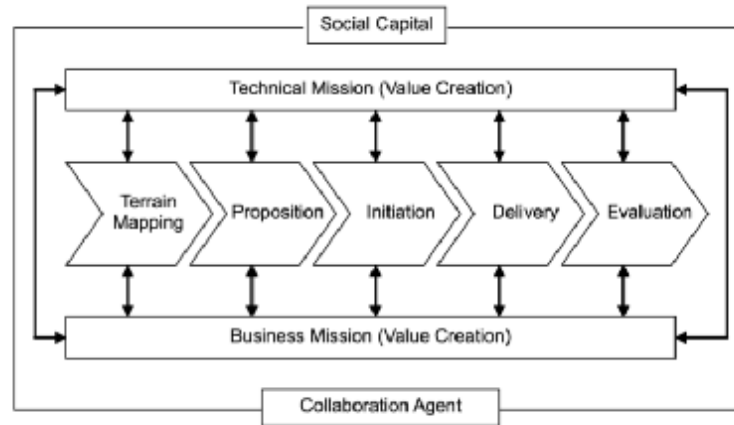


Figure 5: A Process Model for Efficient University-Industry Collaborations

As seen in Figure 5, the outset of the framework is the ‘terrain mapping’ stage where the purpose is to identify and attain the appropriate technical capabilities and industrial requirements for the project. The following ‘proposition stage’ is intended to ensure an appropriate value shared relationship is developed whereby both the academic’s and industry client’s needs are met. Next is the ‘initiation stage’. Much like a proposal, this stage is aimed to complete a contract negotiation and a written statement of work. At this point, the project is ready to commence and the ‘delivery stage’ begins. This involves a significant amount of project management to ensure the milestones are achieved. Finally, the project is reviewed in the ‘evaluation stage’ upon performance measures and recommended for future actions. The framework integrates both the business and technical mission throughout the process and best practices in process, knowledge, and social factors.

2.5 Financial Practices

Sufficient financial capital is critical for sustainable operation in new business ventures and insufficient capital is one of the leading causes of failure. Venture financing and access to seed financing were noted to be factors important for both university commercialization and business incubator success (Dilts & Hackett, 2004) (Rasmussen, Moen, & Gulbrandsen, 2006). A study across one hundred failed early-stage businesses found that the leading cause at 32 percent was ‘undercapitalization and high fixed cost’ (Lussier, 1996). As a business incubator offers services to support the commercialization process, the successful commercialization of the incubatee is a direct indication of the business incubator’s success. As sufficient financial capitalization is one

of the most decisive factors of a business's success, it is important to assist the incubatees to access financial capital.

Business incubators can assist with financing of the incubatee using a variety of services, several of which are common practices across the industry. Surveyed research over 54 of the best performing university affiliated business incubators in North America report the most common financial services of business incubators. The financial services were reported to support: access to seed capital, assistance in financial analysis, procurement of government grant support, help to obtain venture capital financing, prepare financing proposals, assistance with large federal grants, measures to obtain bridge financing, facilitate strategic corporate partnering, assist in evaluation of tenant enterprises, obtain royalty financing, organize joint ventures, and arrange purchase order financing (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). These common services are summarized into three categories of assistance to:

- i. access financial capital in various stages, types, and sources;
- ii. financial modeling and analysis; and
- iii. corporate partnering and joint ventures.

These financial support services are standard among successful business incubators and are offered both directly and indirectly through collaborative efforts. The three financial service areas are aimed to (i) use financial theory to help model the business and (ii) use various types, stages, sources in addition to strategic partnerships for the incubatee to engage financing.

Universities can be very effective assisting incubatees with financial analysis and modeling. Through academic programs, faculty and students can partner with industry business ventures to overlap course work with industry projects. Financial analysis can be completed in these types of projects and value is delivered for students through course credits and real world experience while the business receives value in financial services at a small expense. These types of partnerships have been noted as effective practices around many business incubators with university affiliation (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996).

Business incubators can use a variety of different financing structures that are dependent on the particular incubatee's stage of business, business model chosen, and resources requirements. Elements used in practices to finances an incubatee include:

- seed, milestone, start-up stage financing;
- equity, loan, and grant types financing; and
- venture capital, private investor, corporate, and government sourced financing.

These financing elements are common for business incubators and are each known to have specific advantages for different situations (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996).

In some situations, incubatees may have a technology and mission that benefits another firm as well as their own. In these situations, joint-venturing or corporate partnering may lead to a financial advantage if strategized effectively in the business model (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). University affiliated business incubators can help facilitate networking between potential joint ventures and corporate partnerships.

2.6 Intellectual Property Practices

Intellectual property (IP) is identified as a factor important for both university commercialization and business incubator success (Rasmussen, Moen, & Gulbrandsen, 2006). It is important to consider IP in the development of a commercialization strategy for a university affiliated business incubator as it both helps to strategize the incubatee's competitive position and defines an individuals rights and privileges regarding the discovery. Protection of a business idea in the market is critically important to a venture's commercial success and research suggests improper strategies are one of six fundamental causes of failure for new businesses (Mainprize, Hindle, Brock, & Mitchell, 2003). Many strategies can be identified regarding the type, location, timing, breadth, and depth of IP protection. However, these strategies are highly dependant on the individual incubatees and fall outside of the research scope for this thesis. The following research will focus on IP practices that influence commercial output of industry-sponsored projects that are developed within the university environment. The two parties that will be considered as potential IP stakeholders in this particular scenario are the university and the industry-sponsors. The following discussion will address ownership policies between universities and industry-sponsors as well as management practices for commercialization.

Over the last few decades, discussion of IP ownership discovered within the university environment has been a significant topic of policy discussion. In Canada, the federal government

allows universities to self-regulate policies concerning IP ownership. As a result, universities have differing policies regarding IP ownership that are mostly defined by the legal conditions within the research agreement between the university and industry-sponsor. In contrast, U.S. universities differ from Canadian universities due to the U.S. federal legislation of the Bayh-Dole Act granting the university rights to be assigned intellectual property ownership of any federally funded research discovery. Canadian universities are divided among those that enact policy to retain IP ownership of discoveries and those that do not (O'Donovan Dix & Culver, 2004).

University policy regarding IP ownership in industry-sponsored projects can have significant influence on the commercialization ability of a university. The strategic IP policies chosen will affect the university's capacity to: create university-industry projects, to generate licensing revenues, and to contribute to research projects with real world application as described in Table 4. Table 4, reformatted from the original publication in a research study for university-industry IP relations, describes different IP policies and the resulting effects for the university and industry (Jelinek & Markham, 2007).

Table 4: Relevance of IP Ownership for Industry and University

IP Arrangement	Relevance to Industry	Relevance to University
Industry owns IP that results from collaborative research with universities.	Very high probability of collaborative research. Gives industry the most freedom of action.	High research sponsorship but little upside potential for major breakthroughs.
Industry owns IP, but it allows the university to continue to research and publish.	High probability of collaborative research. Allows continuation of research stream and provides students with attractive research themes.	Allows university to continue with educational mission but again misses out on upside of revenue potential.
University owns IP, but it allows exclusive licenses to industry for any use.	Sustains competitive advantage, but it imposes some limitations on use. Likely to decrease the number of collaborations.	Limits some industry research revenue, but it allows university to participate in very profitable new products
University owns IP, but it allows industry an exclusive license for a narrow field of use.	Can be attractive in some industries but it is limiting. Is acceptable only if whole company interest is in the narrow field of use.	Can maximize the utility of an invention and, in some industries, can maximize revenue. Further limits research revenue.
University owns IP, but it makes it available non-exclusive to any company that wants it.	Limited interest from companies unless it is for very basic science.	Not likely to generate research revenue. Also not likely to license into strong commercial settings that pay royalties.

Table 4 describes an inversely related relationship between university ownership and increased university-industry projects. Moreover, as universities are more aggressive to retain the rights of

IP discoveries, industry tends to lose interest in research collaborations and university-industry research project are less frequent. A strategic balance for university IP ownership and increased number of projects should be considered and aligned with a university's mission.

Other IP management issues are important for universities to consider when developing an IP strategy. For example: clearly defined policies, flexibility in agreements, experienced IP practitioners, and an entrepreneurial culture are important issues to consider. Evidence suggests the US is more productive than Canada regarding university commercialization (Devol, et al., 2006). It has been suggested the US superior productivity is because Canadian universities can be bureaucratic, have slower processes, less experienced IP practitioners, and lack 'superstar' credibility (Agrawal, 2006). Evidence also suggests that IP management strategies should allow for a set of clearly defined policies in addition to flexibility for negotiations within these policies (Jelinek & Markham, 2007). Clearly defined policy gives the stakeholders a sense of confidence and reduces uncertainty within the working relationships. The flexibility within policies is intended to allow some room for negotiation and to accommodate individual requirements of different industry-sponsors. Research has suggested that these tactics have been successful in promoting the creation of new businesses and can help construct an effective IP management strategy.

2.7 Participation of Academic Individuals and Laboratory Facilities

University resources including academic individuals and laboratory facilities have been identified as factors that are important for both university commercialization and business incubator success (Rasmussen, Moen, & Gulbrandsen, 2006) (Dilts & Hackett, 2004). Section 2.7 will discuss the use of university resources to facilitate commercialization in: (i) the participation of students and faculty within entrepreneurial projects; and (ii) the use of laboratory facilities to conduct research and development of technology.

2.7.1 Involving Students in Entrepreneurial Teams

Academic institutions are a rich resource of intellectual capital that can contribute to entrepreneurial team building. Business incubation is considered by many to be a natural extension of engineering schools, and proper facilitation can provide an ideal environment for students to interact with real-world businessmen and achieve an education with less dependence on external funding (Cook, 1996). Within the industry-sponsored projects, students can gain

value within: contract payment for work, equity in the projects, course credits towards academic program requirements, an extended network with industry contacts, and experiences with real world projects (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). Industry-sponsors can gain value when collaborating with students by lower expense of otherwise contracted work and instead deliver value to the student through experience and networks (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). Student participation in industry-sponsored entrepreneurial projects can create value for both parties involved.

2.7.2 Academic Faculty Participation

Academic institutions have valuable resources within faculties, who as experts within their respective disciplines can be a significant asset to high-technology commercialization efforts. Some incentives for faculty to become involved in industry projects are: research overlap, ownership and profit incentives in venture, and contract fees. Industry can gain value through collaborative work with highly knowledgeable faculty. Despite the value for both industry and faculty, some universities have been cited to lack these relationships (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). One reason for lack of faculty participation in industry projects is the fact that industry often have a difficult time connecting with desired faculty, not because of scarcity of faculty, but because there is no clear process to link experienced faculty with industry demand. A variety of techniques and mechanisms are used in practice to facilitate and encourage the interaction of faculty and industry to collaborate in entrepreneurial projects. One popular mechanism is a database system of faculty and their related expertise (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). Entrepreneurs can browse the database and find individual faculty that may have experience relative to their ventures. The incubatees, faculty, business incubators, and universities are then able to negotiate the terms of work on issues pertaining to fees, IP, equity or royalties, and management for conflict of interest. The collaborations with expert faculty can strengthen an entrepreneurial team and give the entrepreneurial project a better chance of success.

Also, an important catalyst to incentivize faculty involvement may be achieved through a supportive entrepreneurial culture. The University of Waterloo attributes entrepreneurial culture as a major reason for entrepreneurial activity around their campus (Bramwell, Wolf 2008). Policies that are supportive of an entrepreneurial culture is a research topic in its own and a

broader focus than the topic of this thesis. Policies and practices to support an entrepreneurial culture for academic participation in commercialization is an area of opportunity for future research.

2.7.3 Faculty Conflict of Interest and Commitment

In some instances, conflict of interest (COI) or conflict of commitment (COC) can be an issue for faculty wishing to participate in industry-sponsored projects. Entrepreneurial university projects can have high potential for COI and COC (O'Donovan Dix & Culver, 2004). These conflicts arise in situations when there is a divergence in personal interest and professional obligation. In addition, COI refer specifically to situations when there is financial concern. The conflicts are most often due to competing interests between academia and business. “The general consensus among experts is that COI and COC cannot be eliminated but must be instead managed” (O'Donovan Dix & Culver, 2004). Table 5 is a reformatted copy from an original publication that describes an array of approaches that universities take to manage these conflicts (O'Donovan Dix & Culver, 2004).

Table 5: Approaches to Manage COI and COC in Universities

Description of Approach	School Example
No policy or honor codes exist; the school relies on faculty to be ethical.	Swarthmore College
A committee reviews sponsor and venture agreements.	Rose-Hulman Institute of Technology
Guiding principles and policies are set for certain situations.	Harvard University
Policy requires disclosure and committee review.	John Hopkins University
Numerous policies exist, including those for the school's participation in start-ups and distribution of equity from ventures. Policy requires annual disclosure	Stanford University

As Table 5 shows, universities can take both aggressive and passive approaches to managing COI and COC. For example, Stanford University uses many policies to govern conflicts whereas Swarthmore College uses none. There is no clear indication that any one set of policies, or lack

of policies, is best to manage potential conflict. In addition to the array of approaches described in Table 5, some additional practices common to many universities include:

- faculty assign their primary priority to the university;
- faculty avoid situations that compromise scholarly independence, limit open and timely exchange of research results, or compromise the integrity of the university; and
- faculty disclose significant professional or financial interests from outside the university (O'Donovan Dix & Culver, 2004).

When these approaches fail to avoid COI or COC, legal action may be required whereby the industry-sponsor's research agreement governs the dispute. The research agreements are self regulated by each individual university. Some potential negative repercussion due to COI and COC include: criminal charges, loss of employment, and legal pursuit of financial losses (O'Donovan Dix & Culver, 2004). These repercussions were cited in situations when policy was too relaxed and unclear, when university policy was too limiting, and when parties took unethical approaches to the guiding policy. It would seem intuitive that although no set of policies can eliminate COI and COC, having transparent policy that include concerns of faculty researchers and the mission of the university can help avoid undesired conflicts.

2.7.4 Access to Laboratory Facilities

Laboratory facilities can be regarded as a value-providing asset for universities assisting technology commercialization. Some research concerning the value added contribution from university affiliated business incubators suggests that labs/workshops and equipment are the second most value enhancing contribution (second only to university image (Mian, 1996)). Practices to facilitate the use of university laboratories and equipment are very common among universities affiliated with business incubators. A study of 54 university affiliated technology business incubators report that 86.2 percent provide access to technical facilities either directly or by referral (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). The overview of the technology business incubators further suggests that many business incubators develop creative partnerships with institutions such as universities to rent and lease laboratory facilities and broker relationships with federally funded laboratories (Tornatzky, Batts, McCrea, Lewis, & Quittman, 1996). This evidence suggests that the use of university laboratory facilities can be an excellent

asset to support commercialization and is provided by most university affiliated business incubators.

2.8 Community Support and Networks

Community support is identified as an important factor for successful business incubation (Dilts & Hackett, 2004). The presences of an entrepreneurial culture and education of the surrounding individuals can be critical to motivate and gain support from the surrounding community (Mian, 1996). It is important to educate the private and public sectors regarding the benefits of entrepreneurship and most importantly to educate and gain support from the key decision makers surrounding the business incubator (Dilts & Hackett, 2004). Research into entrepreneurial culture by Klofsten and Jones-Evans identifies two initiatives that tend to be constructive in engaging the university community and supporting entrepreneurship: (i) separate courses in entrepreneurship, and (ii) training programs for entrepreneurial-minded individuals (Rasmussen, Moen, & Gulbrandsen, 2006). University policy can also help support an entrepreneurial culture. The University of Waterloo (U of W) can demonstrate the ability for policy to embrace entrepreneurial culture as IP policy is suggested to be a significant contributor to the U of W's entrepreneurial culture. The U of W attracts some of the world elite researchers that have an interest in entrepreneurship and IP dividend through policy that allows the researcher to retain the IP rights to research discoveries. A study concerning the entrepreneurial success at the U of W continually cites entrepreneurial culture as a main commercialization catalyst (Bramwell & Wolfe, 2008). This evidence suggests that an effort to engage and educate individuals from within and amongst the surrounding university community, in the context of entrepreneurship, is important to support commercialization.

A network to connect with the business community is another factor deemed important for successful business incubation (Dilts & Hackett, 2004). Further support of the positive influence that networks can have on entrepreneurship was found during a study of the important factors supporting business creation at MIT where community support networks were identified to be second only to student engagement (Hsu, Roberts, & Eesley, 2007). Networks of business people can support entrepreneurs through mentorship and ability to create partnership for access to business resources. A study of the impact of networks to entrepreneurial business spin-offs in the university environment concluded that the effects of networks positively influenced new business

creation (Waltera, Auerb, & Ritter, 2006). The study suggested two practices to help develop effective networks: (i) engage business people, governments groups, and venture capitalists to support the new businesses; and (ii) enable the entrepreneurial individuals and new businesses to effectively access the support within the networks. Entrepreneurial networks are continually cited to be an important factor and supportive influence for new business creation.

2.9 An Overview of University Practices

As described in sections 2.4 through 2.8, several practices to support new business creation through industry-sponsored university projects are identified. These practices are summarized in the following list.

- *Collaborative participation of academics*: with incentives for student and faculty participate and mechanisms to make connections between academics and industry.
- *Educating the university community* through providing entrepreneurial courses in the academic curriculum as well as separate course for all interested in entrepreneurship.
- *Management of COI and COC* through faculty: disclosure of outside interests, upholding academic integrity, and primary responsibility with university employment duties.
- *Use of laboratory facilities*: to provide access for the use of university laboratory facilities.
- *A commercialization process* with transparency using selection, screening, and milestones.
- *Management of commercialization* throughout the project from both the industry and academic perspective.
- *Engaging the community* through: education regarding entrepreneurship opportunities around the university, and gaining support from entrepreneurial groups in the community.
- *Building networks to the community* by both: developing networks to entrepreneurial expertise in the community, and providing the ability for the academics to access the entrepreneurial networks.
- *Providing access to entrepreneurial financing*: to different sources, types, and stages of financing, assistance to develop a financing strategy, and assistance to financial partnering.

- *Intellectual property management practices* with the university to encourage industry-sponsored commercialization including: a reasonable balance of university and industry IP ownership policies, clearly defined policies that give transparency to industry-sponsored research agreements, flexibility to allow for alternative research scenario with industry-sponsor.

To describe some of the practice currently applied at universities, six universities were reviewed herein. The purpose of the review was not to determine the best practices in commercialization but to identify some of the practices that are employed surrounding universities to promote the creation of new businesses though industry-sponsored entrepreneurial projects. Universities were selected for this review based upon their ability to create new business. The Milken Institute Commercialization Index rates universities for their ability to create new businesses and this will be the metric to select universities for this overview (Devol, et al., 2006). The index is limited to North America between the years of 2000-2004. The top three U.S. universities along with the top three Canadian universities are included in the overview. The universities selected are:

- i. Massachusetts Institute of Technology (MIT);
- ii. University of California San Diego (UCSD);
- iii. California Institute of Technology (Caltech);
- iv. University of British Columbia (UBC);
- v. Simon Frasier University (SFU); and
- vi. University of Waterloo (U of W).

A summary of the commercialization practices surrounding these universities is described in Table 6.

Table 6: University Commercialization Practices Overview

Area of Industry Practice	Summary Description of Practices
Participation of Academics Including Incentives and Mechanisms of Participation	Universities all have offices and programs to support industry-collaborative engagement and entrepreneurial projects. Many programs are connected through an affiliated business incubator. A variety of different programs and agreements are used. Licensing profits and fees are used as incentives for participation. University policies can also be used as incentive for participation through IP ownership policies and employment responsibility to engage industry related projects.
Faculty Management of COI and COC	Each university has policies to govern conflicts and also encourage participation in projects outside of the university. Sometimes, adherence to the policies is self-managed and other times managed by the university. Often, first priority is with the university employment responsibility, outside interest must be disclosed, academic ethical and professional standards must be up kept.
Use of Laboratory Facilities	Each university has different policies but all allow some access to use laboratory facilities. Use of laboratory facilities for industry-sponsored projects is always at a cost to the industry sponsor. Sometimes equity deals can help reduce fees for lab use.
Community Engagement Including Support and Education	All universities are affiliated with at least one business incubator. Also, each university has initiatives through programs, centers, and technology transfer offices to promote commercialization from within. All universities have methods to interact and educate the public and a common practice to do this is networking forums.
Networks for Connections to Mentors and Business People	All universities have affiliations to business incubators with programs and initiatives to encourage interaction with mentors and business people. Practices and programs vary between universities.
Educating the University Community	All universities have initiatives to educate students in entrepreneurship. The initiatives include university courses, entrepreneurship centers, student groups, and business plan competitions.
Providing Entrepreneurial Financing, Networks to Financing and Partnering, and Assistance to Financial Modeling	Seed stage financing is used at all universities. Grant financing is a common type but sometimes outside financiers are networked as well, and equity financing is used. Networking to outside financing seems very common. Specific programs to assist with financial modeling for venture financing were not observed but in most assistance support for financial modeling can be given through networks to mentorship and entrepreneurial workshops.
Intellectual Property Management Practices Regarding Ownership, transparency in Policies, and Flexibility to Negotiate	Ownership of IP is most often transferred to the university but sometimes remains with the industry-sponsor. All universities have transparent policies often with standardized type agreements to manage sponsored research for entrepreneurial projects. All universities have some flexibility to negotiate regarding the commercial right to the IP and this can include: retained ownership of IP, exclusive royalty free license for commercial use of IP to the industry-sponsor, and exclusive rights to first license of IP for the industry-sponsor.
A Commercialization Process with Selection, Screening, and Milestones	Each university seemed to use at least some selection, screening, and milestones to manage the commercialization process. All but one university used screening as an important step in commercialization. Other stages included: identification of commercialization options, business opportunity analysis, preparation of a commercialization plan, dealing with the university, preparation of the business plan, launching company activities.
Management of Commercialization Including both Industry and Academic Prospective	On-going management of the industry-sponsored entrepreneurial project did not seem to be an explicit priority for the studied Universities. The only management strategies that were explicitly observed were within the industry-sponsor research agreement.

Table 6 summarizes a variety of practices used in the university environment to: gain participation and manage of academic conflict, access university laboratory facilities, build networks for connections to mentors and business people, establish community engagement through support and education, entrepreneurial education for the university community, provide opportunity for entrepreneurial financing, encourage entrepreneurship through IP management, use a commercialization process, and management of commercialization within industry-

academic collaborations. All universities encourage the use of university resources in academics and facilities although policies differ for individual incentive to participate, accessibility of resources, and university COC and COI. The universities all seem to have a wide variety of community engagement initiatives in entrepreneurial education, networking to mentors and business community, and to private business incubators as well as other business development initiatives. Universities generally used transparent policies to manage industry-sponsored research and intellectual property. All but one university typically retains the rights to IP ownership in industry-sponsored research project; however, most universities allow flexibility for alternative agreements licensing and ownership of the commercial rights to the IP.

Entrepreneurial seed financing was available surrounding all universities and as well as networking to financing. Financing was available through grants and networking to equity financing. Lastly, each university seemed to have at least one explicit step in the commercialization process and the industry-academic management was primarily managed through industry-sponsored agreements defined at the outset of the project. It must be noted that the information collected for these institutions was limited to the information published on the respective university websites and related links and may not include all relevant information. Details of the summarized information shown in Table 6 can be found in Appendix A. Chapter 3.0 will use the findings of the university overview along with the literature findings of the effective practices surrounding university commercialization to develop a commercialization model for the U of S, College of Engineering.

2.10 Chapter Summary

This chapter researches the areas of practice that should be included in the commercialization model for successful university commercialization and new business creation. A business incubator is used to identify the success factors for new business creation as well as a literature review for successful factors of university commercialization. The research identified the successful areas for the commercialization model to include: participation of academics and use of laboratory facilities, access to finances, IP policies that encourage commercialization, networks and community involvement, a commercialization process and management. Further literature research into these areas identified several areas of practice that are important for universities including: collaborations with academics with incentive and mechanisms for participation, faculty management for conflicts, use of laboratory facilities, community

engagement including support and education, practices to provide entrepreneurial financing, practices for effective IP management with the university (ownership, transparent policies, and flexibility), a commercialization process, and management of academic-industry working relationship. A review of university practices confirms that the identified areas of practices are addressed in industry through a variety of different practices and support new business creation. Chapter 3 will aim to include these practices in a commercialization model with a strategy to engage the College of Engineering and available resources therein.

3.0 The Commercialization Model

This chapter will aim to describe a commercialization model that can engage the University of Saskatchewan, College of Engineering to bring business ideas from industry entrepreneurs to the market. The first section of this chapter will develop and describe a generic university commercialization model that includes the areas of practices listed previously in Table 6 to support university commercialization with an industry entrepreneur. The second section of this chapter will describe a business structure in form of a business incubator that will operate the commercialization and engage the College of Engineering. The third and last section will describe how the business incubator will use its available resources to support the incubatees through engagement of the commercialization model. In entirety, this chapter will aim to describe the commercialization model and its implementation through a business incubator in the environment surrounding the College of Engineering.

3.1 Generic University Commercialization Model

This section aims to develop and describe a commercialization model for a generic university that engages the areas of practice listed in Table 6 as important for university commercialization with an industry entrepreneur. The first practice from Table 6 that is introduced within the commercialization model (identified in the 9th row item in Table 6) is *selection, screening, and milestones within a commercialization process*. This commercialization process will follow steps and stages to format the commercialization model in the following section. The Front End Entrepreneurial Process, as described in Chapter 2, will be used to include these steps and stages in the commercialization model. The following discussion will be divided into sections for each stage of the Front End Entrepreneurial Process. Each stage will be discussed in terms of the steps and resources that are used to complete the stage and engage the practices of Table 6. A flow chart illustration will be provided with the discussion to describe the generic steps (illustrated with boxes) and resources (illustrated with circles) within each stage of the commercialization model. Later, in Section 3.3, the generic resources described in this section will be specifically identified for the College of Engineering. The commercialization model discussed in this section will follow the Front End Entrepreneurial Process and within each stage include the steps and

resources necessary to include practices within the areas for effective university commercialization listed in Table 6, Chapter 2.

3.1.1 Idea Generation

Idea generation is considered a prerequisite to commercialization and is the first stage of the Front End Entrepreneurial Process. The goal of this first stage is for the generation of ideas that demonstrate viability in the finance, marketing, and management areas of a business. As is the case with almost any process, the goal is to begin with the highest chance for future success and for the commercialization model this would translate to beginning the process with the highest potential entrepreneurial ideas. The commercialization model will aim to employ practices for the generation of high potential entrepreneurial ideas.

There are many possible sources and inspirations for the generation of entrepreneurial ideas (Vesper, 1995) and this commercialization model will not focus on any one area but instead focus on using networking practices to encourage an innovative environment for the generation of entrepreneurial ideas. Certain practice can help create an innovative environment including the use of open non-traditional and interdisciplinary networking. One way to reach outside of traditional networks is through collaborations of industry and academics. This trend is becoming apparent as open innovation networks and collaborations between universities and firms alike are becoming increasingly important and closed networks are becoming obsolete (Ebner, Leimeister, & KacMar, 2009). Industry is very important to the process as evidence suggests that 43 percent of entrepreneurial ideas come from industry sources (Vesper, 1995). Academics may be equally important with highly technical know-how and, as previously discussed, evidence suggests that entrepreneurial ventures linked to academic institutions are two-thirds more productive than counterparts largely due to the contribution of students and faculty (O'Neal, 2005).

Interdisciplinary networks are also a significant resource to entrepreneurial idea generation as high-technology ventures need the expertise of both science and business disciplines at the very least. The interdisciplinary approach can sponsor creative approaches to problem solving and increase innovative capacity that will result in entrepreneurial ideas with high degrees of competitive differentiation. The result of interdisciplinary and open networks may both increase the amount of ideas and the innovative problem solving capacity resulting in entrepreneurial ideas with significant success potential.

The commercialization model will facilitate networking for idea generation as illustrated in the flow chart of Figure 6.

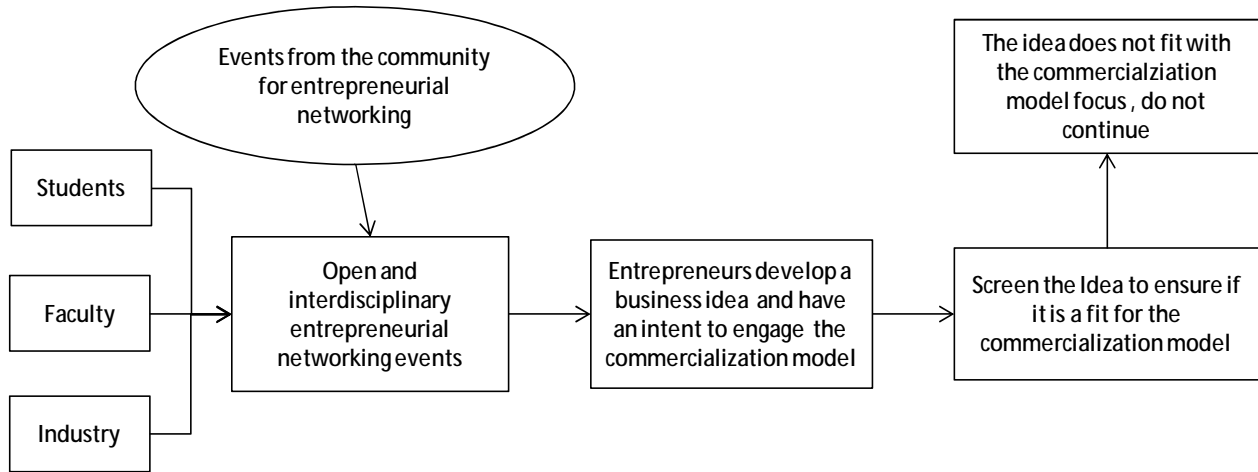


Figure 6: Idea Generation Flow Chart

Figure 6 illustrates the engagement of networking events from around the community to encourage open and interdisciplinary networking opportunities for the generation of entrepreneurial ideas. The first step is to identify and promote networking events for academics, industry people, and other commercialization model affiliated individuals. The networking events may be similar to those overviewed in the industry practices of Appendix A including: open houses, mixers, business plan competitions, luncheons, speaker series, and workshops. To encourage the entrepreneurial idea generation in these events, efforts will be made to (i) educate, build awareness, and gain support from the community regarding the opportunities within the commercialization model, (ii) establish an entrepreneurial theme, and (iii) create interdisciplinary networking opportunities between academics and industry. These networking events introduce practices that are listed in Table 6 (identified the 4th row item in Table 6) for effective commercialization to *community engagement with support and education*. As a result of these networking events, an entrepreneurial idea is generated and the creators of the idea may be motivated to engage the commercialization model. The final step in this stage is to evaluate and screen ideas that do not fit the focus of the commercialization model. Recall that the commercialization model is focused for business ideas that are: originated outside the university, related to the engineering discipline, and in conceptual early stage of development. The selection

of appropriate ideas from the commercialization model follows the practices listed in Table 6 (identified in the 9th row item in Table 6) for *selection of ideas within the commercialization process*. In the idea generation stage, the commercialization model can facilitate the generation of entrepreneurial ideas by engaging open and interdisciplinary networking events and introducing practice for selection of ideas as well as community engagement.

3.1.2 Preliminary Feasibility

The second stage of the Front End Entrepreneurial Process is to screen the idea to determine its preliminary feasibility with intent to determine if the business idea demonstrates enough potential to warrant attention in a full feasibility study. Candidate business ideas will exhibit viability in market related issues, competitive advantages, value creation, and overall business potential. At this early stage it is important to discard lower potential ideas that may otherwise exhaust expensive resources in entrepreneurial failures. New venture survival rate over 5 years are as low as 21.9 percent and venture capital's ability to select survivors are as low as 50 percent (Song & Song, 2009) and lower yet at 20 percent to select big winners (Zider, 1998). To conserve resources on the whole, this stage is for the efficient screening of ideas that demonstrate low value potential and unmanageable barriers to commercialization.

There are several approaches available for a preliminary feasibility assessment and many include a set of scripted questions to guide the process and identify ideas that demonstrate a high risk of failure. Standardized screens have been developed including: New Venture Creation, Progrid Evaluation Solutions, and New Venture Template (NVT) among others. NVT, as an example, has demonstrated that it is an effective tool for venture assessment with the ability to increase successful venture selection rate from 51.9 to 64.3 percent (Mainprize, Hindle, Brock, & Mitchelle, 2003). The NVT analysis addresses fundamental factors of uncertainty and risk in the ventures and attempts to enlighten the potential for success or failure. The feasibility assessment highlights risk of business failure within six fundamentals including: innovation, value, persistence, scarcity, protection, and flexibility. A quick feasibility assessment can be completed within a day and the result is a conceptual understanding of the potential barriers within the commercialization path. The NVT process can be effective for a quick assessment of the business ideas potential to avoid failure and achieve sustainable success.

The commercialization model will facilitate preliminary feasibility by conducting an NVT assessment as illustrated in the flow chart of Figure 7.

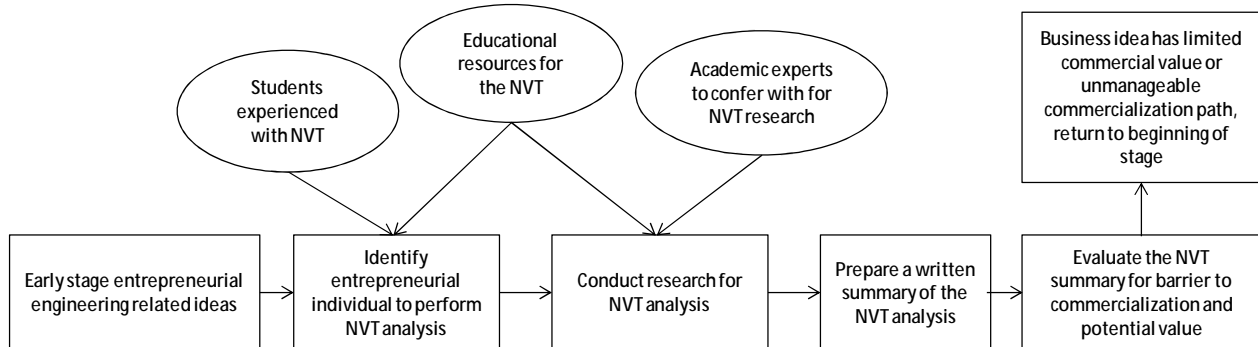


Figure 7: Preliminary Feasibility Flow Chart

The process illustrated in Figure 7 begins with an entrepreneurial business idea as identified in the previous stage. The next step is for the identification of an entrepreneurial individual to complete the NVT analysis. The individual may be the industry-sponsor or a newly recruited individual that is experienced with NVT. The commercialization model will facilitate this step by engaging university courses and providing workshops regarding the NVT process to increase the number of academics that are capable to fill the role of entrepreneur as well as providing a mechanism of interaction between the entrepreneurial academic and industry-sponsor. This step introduces more practices in the commercialization model that are identified in Table 6 (identified the 1st and 6th row item respectively in Table 6) as important for university commercialization in (i) *academic collaborations along with mechanism to support participation* and (ii) *entrepreneurial education*.

The next step is to conduct research for the NVT assessment. The commercialization model will provide the entrepreneur with a platform to network with academic experts for support to complete the NVT research and confer regarding business feasibility. In an effort to support academic participation, at this stage and later stages of the commercialization model, it is important for university policy to support academic interaction with industry. Policy to encourage academic participation with industry can help introduce another practice in Table 6 (identified in the 1st row item in Table 6) for *academic incentives for participation*. After the NVT research is complete it will be formatted in a written summary. Finally the NVT summary will be evaluated for screening of ideas that demonstrate low value potential and unmanageable

barriers to commercialization. The preliminary feasibility stage is for the efficient screening of ideas that demonstrate high likelihood of failure by using the NVT process and to include important university commercialization practices of academic participation and education.

3.1.3 Full Feasibility Analysis

The third stage described in the Front End Entrepreneurial Process is to conduct a full feasibility analysis. This stage is structured for a comprehensive investigation of the merit for future commercial success of the potential business. Within this stage it is particularly important to do a comprehensive assessment for the feasibility of the business because the graduation to subsequent stages will usually account for commitment of significant time and resources that can lead to expensive failures. To avoid expensive failures, feasibility analysis will be conducted to demonstrate not only the merit of the business idea but also that a business development period is feasible. In this stage, the commercialization model will facilitate: research to demonstrate the commercial feasibility of the business idea; the development of a strategy and proposal to sustain the business incubation period; the recruitment of an entrepreneurial team; and the subsequent evaluation of the business opportunity and acquisition of resources to complete the incubation period.

The commercialization model will conduct the full feasibility of the business idea as illustrated in Figure 8.

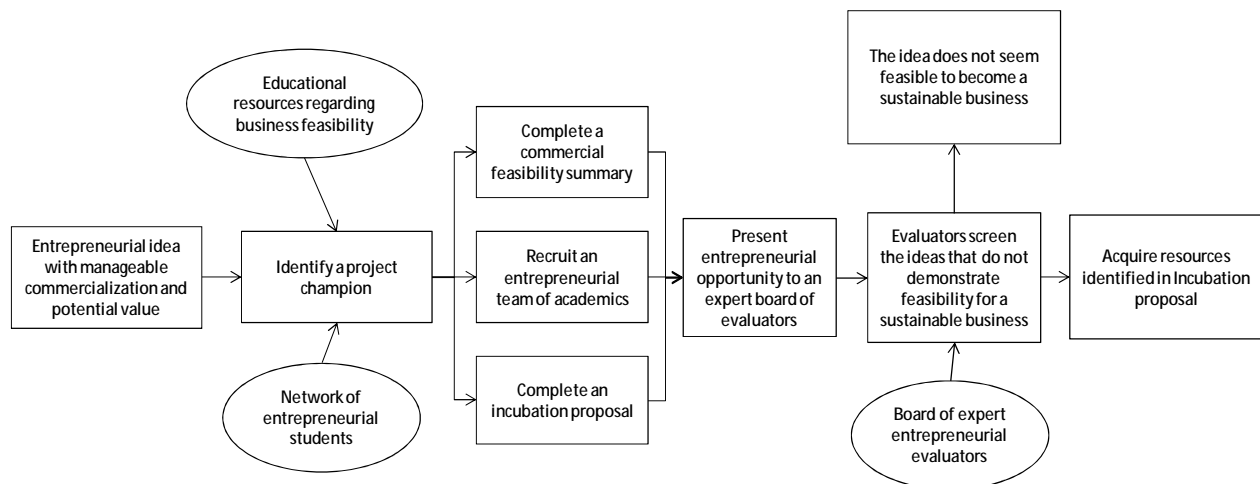


Figure 8: Full Feasibility Flow Chart

The first step illustrated in Figure 8 is the identification of a project champion who will assume a managerial role to oversee the project moving forward. The commercialization model will allow the managerial role of the project champion to coincide with an academic program similar to the programs listed in Appendix A (such as Masters of Business, Entrepreneurship and Technology). The project champion may be the entrepreneur identified in the previous stage to conduct the NVT assessment or a newly recruited academic but their capabilities must include a reasonable understanding of entrepreneurial feasibility and the commercialization model's full feasibility process. The commercialization model will provide support for the recruitment of a project champion by providing educational service regarding business feasibility and a networking opportunity to interact with capable individuals to fill the project champion role. The project champion will be responsible to concurrently manage the subsequent steps illustrated in Figure 8 for full feasibility.

For the steps related to commercial feasibility of the business idea, Figure 9 is a flow chart illustrating in-depth analysis regarding several areas including: product or service, industry and market, financial feasibility, intellectual property, and organization.

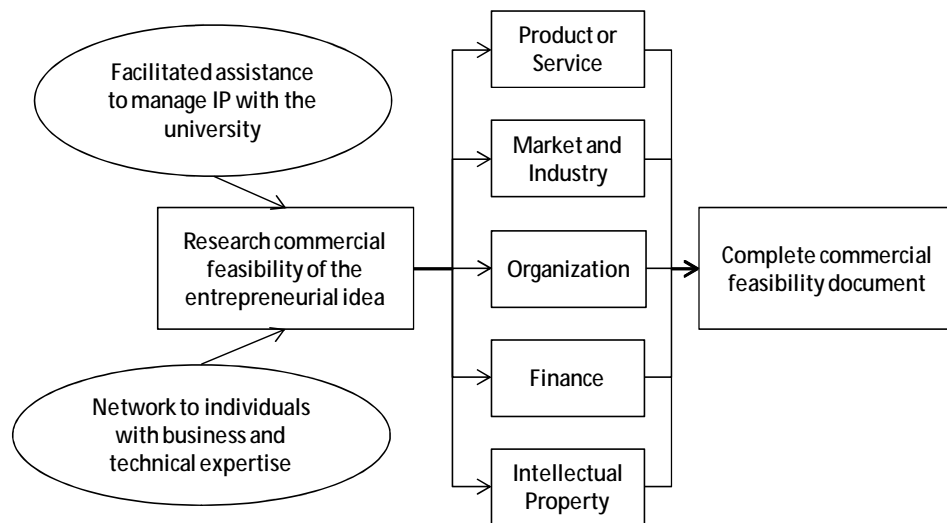


Figure 9: Commercial Feasibility

This assessment will exhaust much more time than the previous stage related in commercial feasibility within the NVT assessment. The areas of research for commercial feasibility are describes in Table 7.

Table 7: Areas of Entrepreneurial Feasibility

Area of Feasibility	Description
Product/Service	The product or service should be technically feasible and designed in a manner that is desired by the target audience. The technology development schedule should fit within the greater commercialization timeline. Prototype development can assist to; demonstrate the potential for technical feasibility; to give direction to methods of production and manufacturing; and to act as a market research tool in the hands of the customer.
Industry and Market	Feasibility should identify the need or problem that the product or service addresses and the general market indicators surrounding. The analysis should reflect: the life-cycle stage of the industry; the target customer; and a realistic financial opportunity within the market.
Financial	An abbreviated form of the full financial analysis that should include an overview of: the start up financing and viable sources; the revenue model; and some projected sales.
Organizational	The venture needs the ability to obtain the capabilities in management as well as other resources to operate the business. Business operations capabilities include: individuals and knowledge competencies to operate; facilities to develop the technology; labor to complete operations, and a means to protect the product or service from competitors. It is not critical at this early feasibility stage to have all capabilities for business operations but it is important to have the ability to obtain the capabilities for future business development. However, it is important at the early stage to have an entrepreneurial champion to drive the project forward.
Intellectual Property	The IP strategy should be identified. It is especially important in the university environment to identify and have stakeholders agree on who will own the IP of any future discoveries.

To assist the research for commercial feasibility, the commercialization model uses general resources including: networking with business people and academics to confer for advice in the areas of finance, product, market, and organization; and facilitates an interaction with the university to manage IP. It should be noted that the interaction with the university for IP management will require practices listed in Table 6 (identified in the 8th row item in Table 6) for university commercialization including: (i) *transparency in policies regarding industry-sponsored related IP*, (ii) *flexibility for alternative agreements with the industry-sponsor*. Ideally the university will have complete flexibility regarding the IP ownership but in a non-ideal world at the least allow the industry-sponsor first opportunity to an exclusive license for the IP. Additionally discussed in Table 7, the resources provided by the commercialization model for interaction with business people introduces practices for university commercialization identified in Table 6 (identified in the 5th row item in Table 6) as *networking with business people*. The completed assessment of commercial feasibility should demonstrate: a need for the product or service, business placement within the industry and market indicators for viability, the ability to access resources necessary for business development, the ability to manage the IP with the

university, and rough financial projections for a sustainable business. The final step regarding the commercial feasibility assessment will be completed with a written summary document.

Concurrent to the commercial feasibility steps, steps for entrepreneurial team recruitment and the development of a strategy to sustain the business incubation period will be completed as illustrated in Figure 8. These three efforts are completed in parallel because they are related and can influence each other. Moreover, business feasibility, entrepreneurial team recruitment, and incubation proposal steps can all have influence on each other and are thus completed in parallel over the same period of time.

Figure 10 is a flowchart that illustrates steps to recruit an entrepreneurial team.

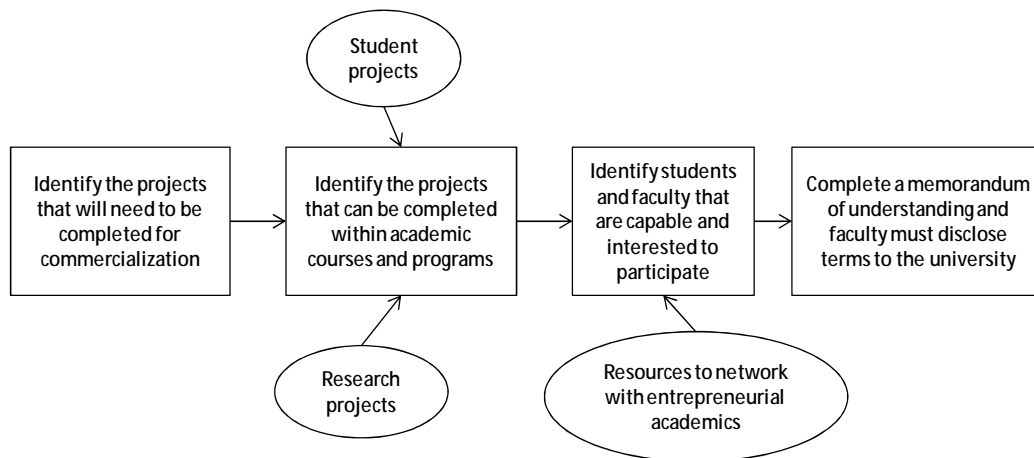


Figure 10: Entrepreneurial Team Recruitment

The first step is to identify the projects that need to be completed for successful commercialization of the business idea. The next few steps are designed to engage academics within the entrepreneurial team. First, the project champion will identify any students that can collaborate with course and program projects or other academics that can collaborate through research projects. For both the research and course projects, the commercialization model will provide a list of programs and courses that commonly interact with industry through collaborative projects. At this point, the desired academic collaborative projects have been identified and the next step is to identify students and faculty that are capable to participate. The commercialization model will provide resources to facilitate interaction with academics in these projects. The inclusion of academics in the entrepreneurial teams through course and program largely focus for the practice to include academic participation in the entrepreneurial teams but

also introduces potential incentives and mechanisms for the academics to participate. The entrepreneurial team recruitment steps support practices identified in Table 6 (identified in the 1st row item in Table 6) including *academic collaborations with incentives and mechanisms to support participation*. If managed effectively, the collaborative projects can provide the academic with incentives to participate through the opportunity to fulfill their academic research missions with additional potential to negotiate a portion of the commercial profits from the project. The final step is to formulate a potential working agreement or memorandum of understanding (MOU) with each of the academics in the prospective entrepreneurial team. In order to avoid conflicts, faculty should discuss the potential collaborative project and MOU with the appropriate university supervisor and ensure that: academic professional standing will not be compromised, employment responsibility will not be compromised, and the university is aware and supportive of the project. The step to disclose the MOU to the university will introduce another practice for university commercialization identified in Table 6 (identified in the 2nd row item in Table 6), that is, *management of conflict of commitment and conflict of interest*. The MOU will become legally binding with use of a memorandum of agreement (MOA) before graduation to the subsequent stage of business planning. The steps for entrepreneurial team recruitment are heavily weighted on academic collaboration as this is a university commercialization model; however, other industry people can certainly become involved as needed. Following these steps to engage with academics through collaborative research and course projects, the entrepreneurial team should be identified for the subsequent commercialization stages.

The full feasibility stage includes steps to manage and strategize the incubation period and these steps are illustrated in the flowchart of Figure 11.

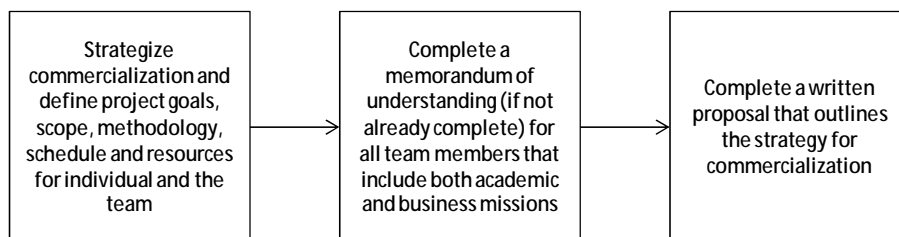


Figure 11: Manage the Business Incubation Period

To strategize the future step in the incubation period, the commercialization model will follow Philbin's industry-academic management model discussed in Chapter 2. The inclusion of Philbin's management model is important for university commercialization practices identified in Table 6 (identified in the 10th row item in Table 6) as *management of commercialization for both industry and academic perspectives*. The management practices will include steps to (i) identify project goals for both the individuals and the team (ii) identify the value sharing terms with consideration of both academic and business missions, and (iii) provide a written statement of work in the form of a proposal that essentially outlines a plan, scheduled deliverables, and resources to complete the incubation period. The three resources that are particularly important to identify in this proposal are finances, laboratory facilities, and core competencies required to effectively complete the project. University laboratory facilities may likely be required for commercialization and it is important to consider a strategy to access the laboratories as it can significantly affect the project costs and time. The commercialization model will facilitate access to the laboratory facilities potentially through the academic research projects or through university services. Access to laboratory space in these entrepreneurial projects introduces another important practice from Table 6 (identified in the 3rd row item in Table 6) as *use of laboratory facilities*. It is also important to consider requirements and potential sources of finances to sustain a business development period in effort to describe a feasible commercialization process. The commercialization model will support sustainable financing for the incubation period with a financing model that identifies the steps to acquire financing from within the local environment. The efforts to support very early stage entrepreneurial financing will support commercialization and introduce a practice identified in Table 6 (identified in the 7th row item in Table 6) as *access to financing support*. The last significant resource to consider is the core competency requirement of the entrepreneurial team that is strategized within previously discussed efforts to recruit the entrepreneurial team. Together, these discussed industry-academic management steps can help strategize the forthcoming incubation period for all the entrepreneurial team members to work effectively towards both personal and entrepreneurial missions.

At this point in the full feasibility stage the entrepreneurial team will be conceptually recruited, the business feasibility document prepared, and an incubation proposal developed. The next step is for a business feasibility evaluation as illustrated in Figure 8. The first step for evaluation is to

present the incubation proposal along with the business feasibility document to a board of evaluators. The board of evaluators will be a resource for the commercialization model and will be comprised of professionals that have a broad range of professional experience. The evaluators will then decide if the business demonstrates feasibility to become a sustainable business and is ready for the next stage of business development. This step is the most involved screening step in the commercialization model and highlights an important practice of Table 6 (identified in the 9th row item in Table 6) in *screening within the commercialization process*. The last step before graduation to the business planning stage will be the acquisition of resources as described in the previously completed incubation proposal.

3.1.4 Business Planning

The fourth stage described in the Front End Entrepreneurial Process is to prepare and write a business plan with the aim of developing a strategy to start-up and sustain the business. The business plan should explain every major aspect of the new venture that can include: product or service description, business model, industry overview and market plan, operational plan, financial plan, risk and uncertainty assessment, exit strategy, human resources, and legal considerations. The purposes of the business plan are to (i) give investors an appreciation of the financial resources needed to sustain the business and (ii) to lay a road map for the business to accomplish its goals, objectives, and vision (Gresock & Barringer, 2008). In essence, the business plan developed should lay out a strategy to start-up and operate the business and allow outsiders to visualize the process.

As the business requirements for each industry-sponsor will be unique, the development of each business plan will also be somewhat unique. Although the components of the business plan will be similar, each will have different focuses for a business start-up strategy. The commercialization model will focus on: educating the entrepreneurial teams on the different components of the business plan, facilitating access to the resources available for business plan development, and ensuring the process is managed effectively as illustrated in the flow chart of Figure 12.

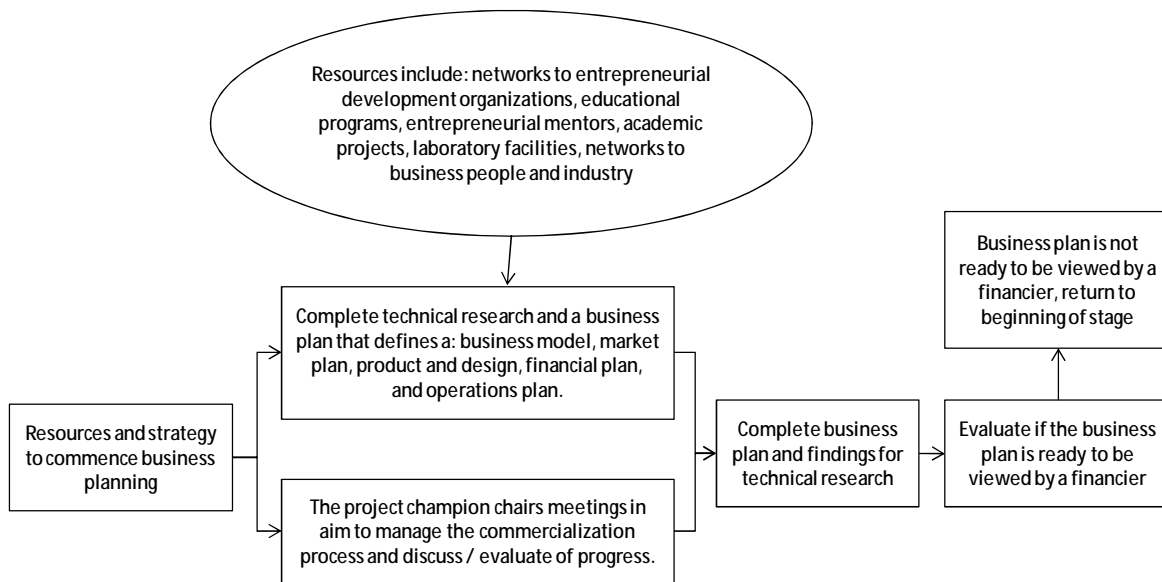


Figure 12: Business Planning Flow Chart

Figure 12 illustrates the business planning stage to begin with a strategy and resources for business development. The next steps are divided into business plan development (on the top portion of Figure 10) and the management of the process (on the bottom portion of Figure 10). The business planning steps are generalized in Figure 10 and illustrated in one step. Instead of describing many steps for business planning, the steps for business planning will be individualized by the entrepreneurial team for each unique project within the previous stage in the incubation proposal. The commercialization model intended to provide resources for various steps in business plan development rather than illustrating the specific steps. The commercialization model will provide resources for business planning including: educational programs for business planning (including financial modeling), university laboratory facilities, networks of business people and mentors, access to collaborative academic projects, networking to other organizations that support business incubations, and other business development resources that may be available in the local community. These resources introduce practices that are identified in Table 6 as supportive for university commercialization including: *networking to business people, use of university laboratory facilities, education of academics, assistance with*

*financial modeling, and community engagement.*⁷ The resources for business plan development are intended to give the entrepreneurs support for the development of a successful business plan.

The bottom portion of Figure 10 illustrates the management of business planning. Management practices will be included in the commercialization model following Philbin's industry-academic management model as discussed in Chapter 2. The management steps are to hold weekly update meetings with the entrepreneurial team and then to monitor progress with reference to the commercialization schedule. In addition to monitoring the project schedule through regularly scheduled meetings the project champion will encourage open and honest team discussions that reduce knowledge barriers and reaffirm a clear team vision of the commercialization goals. The use of Philbin's industry-academic management practices will introduce practices from Table 6 (identified in the 10th row item in Table 6) as *management of commercialization from both industry and academic perspective*. The management practices are intended to ensure productive entrepreneurial teamwork for the development of a business plan.

Following the effective management for the development of the steps within the stage, a business plan will be completed. The final step is for evaluation of the business plan to ensure that it clearly describes the important areas that investors would expect to understand before financing the business. If the business plan is ready for financing then it will graduate to the next stage of business start-up.

3.1.5 Business Start-Up

The fifth and final stage of the Front End Entrepreneurial Process is launching the business, aiming to execute the strategy developed in the previous business planning stages. At this stage, resources are obtained to bring the business plan to action. As each business plan will be tailored to a unique business strategy, implementation of each business will also be unique. The start-up equipment and financial resources differ between businesses but are a significant component of

⁷ In addition to the networks of business people, entrepreneurial development organizations, and entrepreneurial mentors; the commercialization model (does not require as per successful practices identified in Chapter 2, but) could also specifically network to industry firms in attempt to help the entrepreneurial ventures with a path to market. The value and strategy for such networking is outside of the scope of this thesis, but may be a valuable subsequent step for future development of the commercialization model.

any new business. The acquisition of financial capital is possibly the most strategized component of business start-up and will be the focus for this stage of the commercialization model.

Three important methods can be used in practice to assist new venture to acquire start-up capital including: mentorship for a strategy to attract capital, network to potential investors, and mentorship for venture pitch presentations (National Business Incubation Association, 2008). These practices are included in the commercialization model illustrated in Figure 13.

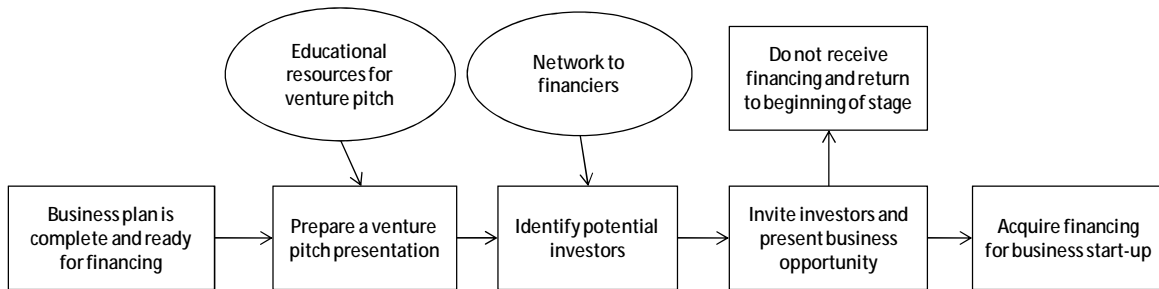


Figure 13: Business Start-Up Flow Chart

As illustrated in Figure 13, the stage begins with a business plan that should include a financing strategy. The next step is to prepare a venture pitch presentation. The commercialization model will provide resources to educate the entrepreneurial teams on the development and delivery of an effective venture pitch. The next step is to identify potential investors for the business opportunity. The commercialization model will provide a platform for the entrepreneurs to interact with potential investors and by doing so, introduce practices identified in Table 6 (identified in the 7th row item in Table 6) as *networking to financial investors and partners*. The incubatees may then invite potential investors to a venture pitch presentation with the aim of developing a partnership and attaining equity financing for business start-up. The entrepreneurial team may go through several venture pitch presentations before finding an appropriate investor. Once the required start-up capital is acquired, the start-up stage will be completed and this will result in graduation from the commercialization model. At this point, the business venture should be ready to start-up and begin operations.

3.2 The Engineering Entrepreneurship Center

The implementation of the commercialization model is strategically organized as a business structure that both engages the College of Engineering and operates the commercialization model

with the purpose of creating new businesses. The business structure will follow the definition of a business incubator and will be referred to as the EEC (Engineering Entrepreneurship Center).

No research conclusively suggests that there is one best business structure for the commercialization of knowledge surrounding universities; however, some research suggests certain structures do have specific advantages. Research by Markman categorized three business structures and related the performance of each to create new businesses. The structures included (i) privately operated for-profit structures, (ii) non-profit privately operated research foundations, and (iii) traditional university operated structures. The research concluded that the for-profit private business incubator structures were more productive than the other two structures in terms of creating new businesses (Markman, Phan, Balkinc, & Gianiodis, 2005). One reason for the superior productivity may be that a privately operated structure has considerably less bureaucracy than university structures. The inherent bureaucracy of a large organization such as a university can add risk to an already uncertain entrepreneurial endeavour, and that can add hesitation for private entrepreneurial investment (Markman, Phan, Balkinc, & Gianiodis, 2005). From the university perspective, the privately operated structures can also have an advantage as it can protect the university from potential legal liability issues that may develop through entrepreneurial ventures (Markman, Phan, Balkinc, & Gianiodis, 2005). Another potential reason for the superior productivity in for-profit privately operated structures is that equity financing is more productive for new business creation than licensing deals (Markman, Phan, Balkinc, & Gianiodis, 2005). Equity positions are more difficult for university-operated structures as there are inherent liability and bureaucratic limitations as compared to a privately operated structure; however, universities can still partake in equity deals through financially sponsoring an affiliated privately operated structure and avoid the bureaucracy and liability risks. Also, equity deals are somewhat redundant for non-profit structures as the purpose of equity is to make a return on investment and generally does not fit a non-profit organization's mission. In summary, the for-profit privately operated business incubator structure seems to be the most effective choice for a commercialization model that aims to create new businesses. For this reason, the EEC is assumed to be structured as a for-profit privately owned business incubator.

3.2.1 The EEC Mission

The mission of the EEC is to engage the resources of the local environment in the College of Engineering and surrounding community to create wealth for stakeholders by commercializing technology through new business creation. The EEC also has specific goals for the stakeholders to:

- i. provide real world education for students and ability to participate in entrepreneurial projects;
- ii. provide a new source of entrepreneurial projects for faculty to participate through collaboration of their research goals;
- iii. provide attractive investment opportunities; and
- iv. provide industry entrepreneurs a mechanism to support the creation of new businesses.

3.2.2 Business Model

The EEC will aim to operate the commercialization model and utilize the resources of the College of Engineering as a value added service to industry entrepreneurs for the creation of wealth through new businesses. The EEC will earn revenues through a service charge for the incubatees as well as making equity investments for return on investment (ROI). The services charges are a very common practice among business incubators and can help motivate the incubatee to complete the incubation process in efficient time as shorter incubation duration results in lower fees and cost for the incubatee. It is also becoming common for some business incubators to make early stage equity investments in incubatee businesses. Equity investments between incubator and incubatee can serve to overlap a common goal of entrepreneurial profitability and add extra motivation to achieve entrepreneurial success. The use of service fees and equity investments together will support a timely commercialization process for the incubatee as well as a closely shared goal between incubatee and incubator for entrepreneurial success.

3.2.3 Client Focus

The client focus for the EEC will remain consistent with the commercialization model's focus for business ideas. This includes business ideas that are: early stage conceptual businesses, originating from industry sources, and related to the engineering discipline.

3.2.4 Organizational Structure

According to the National Business Incubation Association's (NBIA) publication to benchmark staffing practices (National Business Incubation Association, 2008), duties need to include the capability to: (i) grow companies and help them succeed, and (ii) sustain the business incubator itself. A large portion of these duties often falls on a business incubation manager who is relied upon to be: landlord, accountant, teacher, recruiter, psychologist, and public relations officer. Often this is too much of a workload for one manager and duties of fundraising, facilities maintenance, marketing, and public relations can distract from direct support of the incubatees (National Business Incubation Association, 2008). The NBIA report that, among their ten best practices for business incubators, the majority of incubation staff focus should be for business development of the incubatees. For these reasons, the EEC will employ two managerial positions each having an alternative focus of (i) fundraising, facilities maintenance, marketing, and public relations and (ii) attention to the incubation process and the needs of the incubatees. The NBIA also acknowledges that incubators often lack productivity due to being under-staffed, as research suggests that investments for sufficient capability and quantity of staff can pay higher return than the alternative of understaffing or under-qualified staff (National Business Incubation Association, 2008). In addition to these two managerial positions, and to help support the most vital role of a business incubator for the support of the incubatees, an advisory board will also assume some responsibility to help mentor the incubatees. The strategy for the EEC will be to start small, lean, and versatile with staffing for the basic managerial positions and administration and grow with business demand as needed.

3.2.5 Staffing and Operational Duties

The duties to operate the EEC are described within the following organizational positions.

Incubator Director: Responsible for a sustainable business direction of the EEC. The Director will be responsible to ensure employment of a proper marketing strategy, sufficient facilities to operate the EEC as intended, and financial sustainability, as well as to establish and maintain community relations and networks to business mentors. The Director will supervise and advise the Manager to ensure the incubatees are experiencing healthy business development toward commercialization.

Manager: Responsible for interaction with incubatees and to facilitate and add value in regard to business development. The manager will monitor incubatee business development by ensuring effective use of the commercialization model and all of its resources and services. The Manager will work with business mentors, University of Saskatchewan and ILO, students and faculty, and other business development organizations to facilitate networking and entrepreneurial support for incubatees.

Administration: Responsible for performing traditional duties of an administrative assistant that help facilitate the flow of work. The position will require someone to handle scheduling and appointment bookings, correspondence and communication, written transmissions, and to answer phone and handle inquiries. The administration will also be required to assist with event planning and organization for networking events. The day-to-day duties will be continually changing as the needs of the business change.

Accounting and legal work will initially be outsourced.

3.2.6 The Advisory Board

An advisory board of experienced business people will be developed to give the EEC strategic direction and help support the business incubation process through mentorship of the incubatees. Business incubators are often financially limited and resort to recruiting board members as volunteers instead of paid positions. The EEC will follow this financially lean model and recruit a volunteer board of advisors. As the board is on a voluntary basis, and the prospective members may be busy individuals, absences from board meetings may be expected. To accommodate the occasional absences, a large board will be developed so that each board meeting is likely to have representation with a diverse group of business and technical expertise. The large advisory board will also be helpful to potentially build the EEC networks. The board will be comprised of roughly fifteen volunteer professionals that include engineering faculty, business people, accountants, lawyers, financial experts, manufacturing experts, engineering design specialists, IP practitioners, and entrepreneurs. The Board will be chaired by the EEC Director with an aim to meet quarterly for the purposes of: (i) evaluating the status and recommending steps to support the strategic direction of the EEC, and (ii) meeting with the incubatees for evaluation as they proceed to acquire financing for the EEC. The large volunteer board of advisors will assist the

EEC through extensive networks and broad range of experiences that will support both the strategic direction of the EEC and the business development of the incubatees.

3.2.7 Facility Requirements

The EEC will employ a strategy to acquire enough facilities to effectively operate the commercialization model but will also aim to remain financially lean and not attempt to manage substantial infrastructure facilities as many incubators do. Following this strategy, initially the EEC will be structured as a virtual business incubator that offers services to incubatees for business development, not in a physical location, but in a controlled environment. The EEC will only provide office space for its staff. Office space is not a necessity for business development and the aim of the EEC is to remain financially lean and grow operation and facilities as demand increases. Several examples can be cited in *The Tech Transfer Library Start-Up Strategies* that illustrate the effective method to launch the business incubator virtually and subsequently grow to include physical office space a later date when demand for such a facility is proven (2Market Information Inc., 2010). However, a major value added service of the EEC will be to facilitate the use of College of Engineering laboratory facilities that will be done on a case basis with U of S Research Services and the ILO. The EEC will have office space for the incubator staff and facilitate for the use of laboratory services in the College of Engineering.

3.2.8 Financing the EEC

The EEC will look to several public, private, and philanthropic sources to acquire start-up capital. Business incubators are commonly financed through a mix of private and public sources. The mix of sources can be dependent on the mission, organizational structure, and resources available for the particular organization. Research suggests that public financing is very common throughout the overall business incubator industry at seventy percent (Knopp, 2008). Public, private, and philanthropic financing are all used in industry as can be confirmed by the industry review of six universities and affiliated business incubators in Appendix A. The review shows that a variety of different financing sources are used for the business incubators including philanthropic donations, government sponsors, university investments, and business community investments. With the variety of sources described, it seems reasonable to assume that no one financing model is best for all scenarios and financing sources should be selected in context of

the local environment. The EEC will pursue all financial sources that are available and share a common organizational mission.

This thesis will not identify one best financing scenario for the EEC but rather a variety of potential financing sources from the surrounding community in university investment, philanthropic donations, private investment from the business community, and government subsidies. Table 8 describes some of these potential sources of financing in the local Saskatoon community.

Table 8: Potential Sources of Financing for the EEC

Potential Financing Sources from the Surrounding Community	Description of Sources
University of Saskatchewan	As is the case at UBC with Research Enterprise, the U of S could be the primary private financial sponsor of the EEC. In this scenario the U of S would benefit financially through equity investment in the EEC and the incubatees and have limited legal liability.
Private Donor as Philanthropic Investor	As has been the case for the College of Engineering in the recent past. A private donation may be given to support entrepreneurship and new business creation to support such an organization as EEC.
Public Sponsors such as Innovation Saskatchewan, Enterprise Saskatchewan, or Western Diversification	Government organizations may be ideal to contribute financial support of an entity such as the EEC to support entrepreneurship and new business creation.
Private Business Sector Investments	No one private entity is specifically identified but certain businesses (i.e. VC firms) may find an opportunity to become an equity investor in the EEC.

Table 8 describes several potential financing sources for the Saskatoon environment including: the U of S, successful alumni philanthropic donations, Enterprise and Innovation Saskatchewan, and potential venture capital investment firms.

To sustain finances, for-profit business incubators use fees and equity investments with incubatees for income (Becker, 2006). Equity financing can reinforce a business incubator's profit driven mission and help lead to higher productivity in creating new businesses (Markman, Phan, Balkinc, & Gianiodis, 2005). In addition to equity investments, it is very common for business incubators to charge the incubatees fees for service which can both (i) motivate the incubatee to graduate the commercialization process in a timely manner and (ii) help the incubator remain financially sustainable. The EEC will use a financial model that includes both incubatee equity investments for ROI as well as charge service fees to the incubatees.

3.3 Operating the Commercialization Model through the EEC

The following section will aim to identify some of the resources within the College of Engineering and surrounding community that the EEC can utilize to facilitate the commercialization model for new business creation. The discussion will follow the format of Section 3.1 with stages of commercialization but focus on identifying specific resources that the EEC can utilize from the College of Engineering and surrounding community to support the commercialization model.

3.3.1 The EEC Idea Generation

The idea generation stage, as discussed in Section 3.1.1, is for open and interdisciplinary entrepreneurial networking. The EEC will facilitate idea generation by engaging networking events from around the community as well as the implementation of the EEC's own networking event.⁸ The goal at these networking events will be to develop awareness of the opportunities for entrepreneurs with the EEC as well as encourage entrepreneurial discussion for the generation of new entrepreneurial ideas. Recall Figure 6 describes the process for idea generation within the commercialization model and the EEC will facilitate this by engaging various networking events that are described in Table 9.

⁸ These networking events represent a fairly simple form of marketing for the EEC and a full marketing plan is outside of the scope of this thesis but recommended to be completed before implementation of the EEC. The networking events are discussed as an effective activity for the generation of entrepreneurial ideas that can be part of a greater marketing plan for the EEC.

Table 9: Local Networking Events

Networking Event	Description
Engineering Capstone Design Projects	Engineering Capstone Design events showcase projects that have students applying science to solve problems that are sources from within industry.
Saskatchewan Association of Rural Municipalities	SARM is the independent association that represents rural municipal government in Saskatchewan. SARM events gather rural municipal administrators, government representatives, and industry. These events can be an effective place to explore entrepreneurial solutions to meet rural needs.
Entrepreneurial Foundation of Saskatchewan	EFSK is member-based, non-profit organization formed to provide advisory services, training and mentorship to entrepreneurs seeking access to investment capital. EFSK networking events bring together entrepreneurs and experienced business people in an environment that supports new business creation.
Dragon Pitch Party	Is an event put on by the W. Brett Wilson Center to create networking opportunities and connections between academics and industry people.
Gown Meets the Town	The event is an opportunity for the Saskatoon business community to see showcased work of U of S students and provide a networking platform for industry and academics.
SYPE Events	Saskatchewan Young Professionals and Entrepreneurs (SYPE) is a group of young professionals working together to promote business and opportunity in Saskatchewan. SYPE events bring a variety of individuals from different background with the purpose of creating networks to support young entrepreneurs
CJ Mackenzie Banquets	The C J. Mackenzie Gala of Engineering Excellence is an opportunity for our students, faculty, staff, industry alumni to network and celebrate the achievements of our most accomplished colleagues and students. The event creates a perfect opportunity for interaction between academics and industry.

Table 9 describes several suitable events that can be used to facilitate networking but it should be noted that; no one of the community events are critical for the EEC operations, and Table 9 is not an exhaustive list (other events may be a part of the EEC's networking efforts). The EEC will ideally work with the event organizers to establish a small role in the event similar to a sponsor. The goal at the networking events will be to (i) educate the community regarding the entrepreneurial opportunities within the EEC, (ii) create a platform for excellent networking; and (iii) create opportunities to become involved in entrepreneurial projects. The EEC will also create and host a new networking event. The event will be a by-yearly seminar speaker series with different entrepreneurial topics. The EEC event guests will include the EEC associates, student, faculty, industry representatives, and entrepreneurs.

3.3.2 The EEC Preliminary Feasibility

The preliminary feasibility stage is for the investigation of whether the business idea demonstrates potential to create value and avoid unmanageable barriers to commercialization. As described in Figure 7, the preliminary feasibility stage will be conducted through an NVT assessment of the business idea. The commercialization model identifies areas where resources may be supportive for the NVT assessment. The EEC will facilitate this preliminary feasibility stage by providing educational opportunities regarding the NVT process as well as opportunities for the incubatee to network with students capable of conducting an NVT assessment and faculty that can be consulted regarding the technical areas of NVT research.

To facilitate networking opportunities for incubatees with the academics, the EEC will provide the Students and Faculty Database. The Databases will be voluntary and provide a platform where the academics can create a profile of their expertise and professional interests. The incubatees can then review the EEC Databases to identify potential candidates for the entrepreneurial project. The EEC will recruit academics to become part of the Databases through entrepreneurial courses (such as Commerce 349 –Introduction to Entrepreneurship), entrepreneurial programs (such as the Engineering Entrepreneurship Option or the Edwards MBA), and faculty research seminars. In addition, the EEC will coordinate many workshops within the commercialization model to educate the incubatees and academics regarding the NVT process and attendees may also become part of the EEC Databases and help to continually maintain the Database with capable entrepreneurial individuals. The EEC Student and Faculty Databases will be the most significant resources that the EEC provides to facilitate preliminary feasibility.

3.3.3 The EEC Full Feasibility

This stage is for a full investigation of the business opportunity to create value through commercialization. Recall the full feasibility stage is for a detailed assessment of the business idea's commercial feasibility, the recruitment of an entrepreneurial team, the development of an incubation proposal, and the subsequent feasibility evaluation as described in Figure 8. The EEC will facilitate full feasibility assessment by providing:

- networking with academics and business people,
- identification of the academic programs and projects for collaborative participation,

- educational workshops regarding areas of business feasibility,
- facilitation of IP agreement with the university through the ILO, and
- a board of expert entrepreneurial evaluators.

As described in Figure 8, the first step in full feasibility is the identification of a project champion who will be responsible to oversee the entire commercialization process and be capable of assessing entrepreneurial commercial feasibility with the EEC model. The EEC will support this step by providing networking opportunities to academics that have potential to fill the role of project champion with the use of the Student and Faculty Databases. The EEC will help ensure the potential project champions are capable of managing this full feasibility stage by providing a workshop regarding all of the areas within the full feasibility stage. The EEC will also engage certain academic programs that the project champion can use to coordinate the commercialization project such as the Engineering Entrepreneurship Option, the Edwards MBA program, or a Master of Science program with an entrepreneurial topic. Currently these programs have areas that overlap the workload of the project champion and the EEC will continue efforts to strengthen the overlap and potential for project champion involvement through these programs.

The commercial feasibility of the business opportunity will be assessed in the areas of: IP, product/service, organization, market/industry, and finance. Table 10 describes the resources that EEC will use to facilitate the feasibility assessment of the business opportunity.

Table 10: Support for Commercial Feasibility Assessment

Area of Support	Description
Intellectual Property	EEC Manager will help facilitate efficient IP agreements for the industry-sponsor with the ILO.
Product/Service	EEC Database of Faculty will provide access to experts regarding technical feasibility of the product or service.
Organization	EEC steps to build an entrepreneurial team will ensure the organization is built with the necessary core competencies.
Market/Industry	EEC Network of Business People & Industry will provide access to specialists regarding market demand and industry barriers.
Finances	Simplified financial templates will be provided by the EEC.

The EEC full feasibility workshop will educate the project champion regarding the resources listed in Table 10 with the aim that the incubatees receive the full potential of the resources available in this stage.

The recruitment of an entrepreneurial team is a parallel effort to the commercial feasibility assessment. Recall the steps illustrated in Figure 8 for team recruitment are to: identify the projects that need to be completed for commercialization, identify the projects that can be completed through academic courses and research programs, identify potential individuals to participate through the academic projects, and formulate a MOU and MOA with the new entrepreneurial team members. The EEC will support the project champion to identify the potential academic projects by: (i) providing an EEC List of Academic Course & Programs for Collaboration and (ii) recommending which of the academic programs and courses would be ideal for the incubatees. Some of the academic programs and courses that are recommended are described in Table 11.

Table 11: Academic Program and Course for Entrepreneurial Collaboration

Course Project or Research Program	Description
Master of Business Administration Program	The U of S MBA program students are required to complete an industry project. The project can be ideal for entrepreneur projects, business planning, and commercialization strategies.
Engineering Capstone Project	U of S Engineering students are required to complete a capstone project that relates to their area of study in their final year. A requirement of these projects is that they are sponsored by industry. These projects could potentially be structured as a collaboration between student groups and incubatees.
Master of Science Program	The Master's of Science Programs can be ideal to carry out research projects from industry. This can be an ideal scenario of industry-sponsored research to be carried out by students.
Course Projects in Marketing, Finance, EEO Capstone	Many courses in the undergrad programs require industry collaboration for real world student projects. These project can be ideal for industry-academic entrepreneurial collaborations.
Faculty Research	Academic research can be more easily funded by government grants when there is a commercial application. These project can be ideal for industry-academic entrepreneurial collaborations.
i ³ idea Challenge	A business planning competition at the U of S that brings students together through entrepreneurial projects.

After identification of the candidate academic projects, the EEC will provide networking opportunities to individuals that can participate in these academic projects through the EEC Student and Faculty Databases. The EEC will help manage the negotiations for working terms

between incubatee and potential academic collaborators but the incubatee and academic will be ultimately responsible for the design of the working relationship. The MOU is to be legalized through an MOA as the last step of full feasibility with assistance from a legal expert from the U of S College of Law. The resources of these steps are intended to help identify the potential academic projects and individuals as well as formalize working terms for involvement in the entrepreneurial team.

The third portion in the full feasibility stage is to develop and document a plan to complete the incubation period. As Figure 8 describes, this includes the basic elements of a proposal including project goals, methodology, schedule, and resources required for commercialization. The resources that are particularly important to identify within the commercialization model include financial, core competency, and facility requirement. To give support for these resources first, the EEC will help the incubatees acquire their desired needs for core competencies through the recruitment of an entrepreneurial team as discussed in the previous paragraph. Second, most of the incubatees will require technology research and development (R&D) and it is important to identify a plan to resource laboratory facilities and accomplish the R&D. The use of laboratory facilities will be case dependent for each incubatee. The EEC will help facilitate the use of laboratory facilities with the respective managers of each of the laboratory facilities at a potential cost through Research Services. Third, a financial plan should be identified to sustain the incubation period. The EEC will provide resources to help strategize a financially sustainable incubation period with the EEC financing model discussed in Section 3.3.6. Through these efforts, the EEC will help provide resources to help strategize financial capitalization, a capable entrepreneurial team, and laboratory facilities for R&D.

The final steps of the full feasibility stage are to evaluate the incubatee regarding feasibility for the sustainable success of the business as illustrated in Figure 9. The EEC will provide support for evaluation of the incubatee's feasibility by utilizing the expertise of the Board of Advisors. The entrepreneurial experience of the Board of Advisors will provide a valuable resource for assessing whether the incubatee should proceed to the subsequent stage. With graduation granted by the Board of Advisors and the attainment of the resources required for commercialization, the incubatees should be well prepared for the subsequent business planning stage.

3.3.4 The EEC Business Plan Development

This stage is for the research, managed development, and completion of a business plan. Recall from Section 3.1.4 that each incubatee will have a unique business plan development strategy and the following discussion will identify the resources that the EEC will make available to support business plan development. Figure 10 describes several areas for supportive resources within the commercialization model including: networking to entrepreneurial mentorship, educational programs, student projects, laboratory facilities, and networking to entrepreneurial development organizations. The EEC will provide support in these areas using the resources described in Table 12.

Table 12: The EEC Support for Business Planning

Resources for Entrepreneurial Support	Description
EEC Network of Mentors	A group of business and entrepreneurial individuals that are interested in supporting entrepreneurs in mentorship roles. Incubatees can build relationships and gain guidance from the mentor for direction in business plan development.
i ³ Idea Challenge	A W. Brett Wilson Center entrepreneurial competition that provides resources and inspires idea generation, entrepreneurial networking, entrepreneurial training and education. Incubatees can collaborate with students to gain value from resources of the i ³ Challenge.
Saskatchewan Venture Forward Business Competition	An entrepreneurial business competition for post secondary students to support business planning and the creation of new businesses. Incubatees can collaborate with students to gain value from resources of the Venture Forward Competition.
Student Course and Program Work	Many courses and programs at the U of S require industry projects for credit. Incubatees can partner with students in these projects to support the development of the business plan and provide the students with interesting entrepreneurial projects.
Springboard West Innovations Inc. (SBWI)	SBWI is a non-profit organization established to help innovators transform an idea into a commercial reality. Incubatees can use SBWI's service in support of the business planning.
Entrepreneurial Foundation of Saskatchewan	The ESFK supports new business creation and can provide mentorship resources to support business plan development for incubatees.
The EEC Workshop	A workshop that will be hosted by EEC to educate the incubatee teams for the areas that are important for entrepreneurial business strategy and business plans.
Engineering Facilities	Many of the technologies that are suited for the EEC will require research and development. The engineering facilities will be made available at a cost for the incubatees to complete research and development

Table 12 describes resources that are intended to gain academics' participation, gain mentorship from the entrepreneurial experts of the business community, facilitate use of the university laboratories, and educate the entrepreneurial team regarding business plan development. These

resources are intended to support the incubatees in the development of a financeable business plan.

3.3.5 The EEC Business Start-Up

The final stage of the commercialization model is to attain all the financial resources needed to start the business. Recall from Figure 11, in this stage the incubatees will prepare a venture pitch presentation, identify the potential financial investors, and then deliver the venture pitch aiming to acquire equity capital. The EEC will support this stage by providing the incubatee with (i) education and mentorship to create and practice a venture pitch presentation and (ii) the EEC Network of Financiers. First, the EEC will conduct a workshop to educate the incubatees concerning the development of a venture pitch and equity negotiations. Second, the EEC will provide the incubatees access to financing through the EEC Network of Financiers. The EEC will recruit investors from around the local community to be part of the EEC Network of Financiers. The EEC Network of Financiers will provide the incubatees with a list of potential financiers and their contact information.

3.3.6 Finance Model

Practices to finance early stage entrepreneurial projects are very important for business incubation as discussed in Chapter 2. The EEC will support business incubation as well as generate profit using equity investments in the incubatee companies. The EEC will facilitate a process for financing incubatees by engaging several financial sources as illustrated in Figure 14.

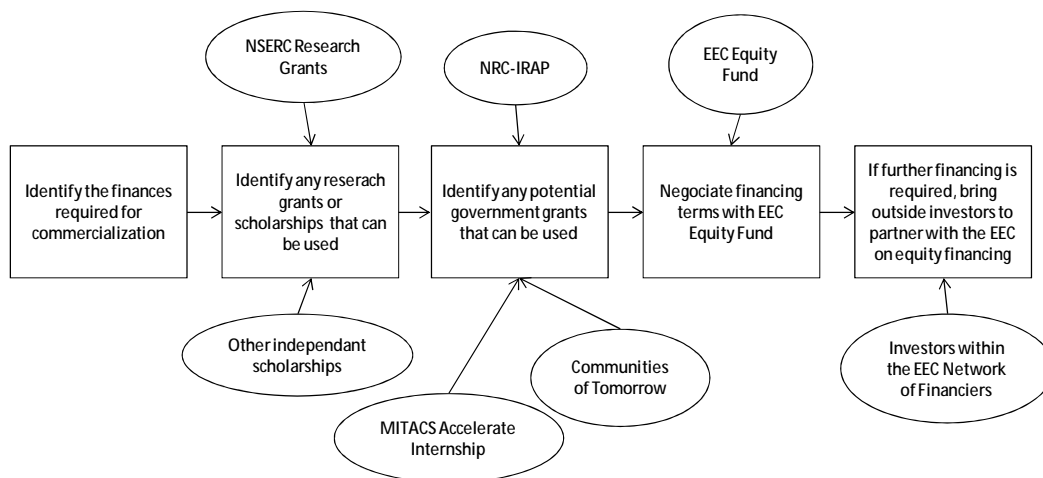


Figure 14: The EEC Financing Model

The financing process illustrated in Figure 14 begins with the identification of the finances required to sustain the incubation period that should be completed in the commercial feasibility steps of the full feasibility stage. Next, the incubatee must pursue financial support in research grants and scholarships that can be acquired through academics that are collaboratively involved within the entrepreneurial team. These scholarships can help to support the researchers themselves as well as the costs associated with research. The National Science and Engineering Research Council of Canada (NSERC) may be a significant source for these grants with a long list of student scholarships and faculty research opportunities that can be viewed on the NSERC website (National Research and Engineering Council of Canada, 2010). There may be some uncertainty regarding the award of such grants and contingencies should be factored into the financing strategy. Next, the incubatee will identify whether the more financial support can be gained through use of government grants that support entrepreneurship. Many entrepreneurial grants exist and some are described in Table 13.

Table 13: Government Grant for Entrepreneurship

Government Entity	Description
NRC-IRAP	NRC-IRAP operates on a shared-risk model, providing cost-shared financial assistance for research and development projects that meet both the firm and project assessment criteria.
Communities of Tomorrow	Communities of Tomorrow provides project funding to assist companies, municipalities, and researchers to prove out and demonstrate innovative technologies and processes.
MITACS	The MITACS program is a government subsidy program to provide internships for Graduate Students.

All of the programs noted in Table 13 can help to financially support early stage business development. NRC-IRAP may be ideal program for the commercialization model as one of their capabilities is to fund new technology development to reach the market. NRC-IRAP follows certain guidelines for funding that agree with the missions of the EEC but typically make funding decisions for business based on a relationship with the particular entrepreneur. In regard to these relationships, the EEC could help develop a relationship between the incubatees and NRC-IRAP where NRC-IRAP understands commercialization process and the detail commercial preparations that the EEC incubatees complete before funding. This may provide an available avenue for a quick form of government NRC-IRAP funding facilitated by the EEC for the incubatees.

The final resource to acquire financing for commercial cost of the incubatee is to use the EEC Equity Fund. The EEC equity fund will make equity investments in incubatees companies within

the range of \$10,000 and \$50,000 in return for 1 of 5 percent in equity as a general rule of thumb.

⁹ In the unlikely case that further financing is required, the EEC will look to a private financier to partner in the equity financing deal. The desired result for the incubatee is full financing of the incubation period with an equity investment through the EEC that is leveraged by various public grants and scholarships.

3.3.7 Intellectual Property with the U of S

Practices for intellectual property management are important for successful commercialization in the university environment as discussed in Chapter 2. The EEC will facilitate the interaction of the ILO and incubatee to reach an agreement regarding the commercial use of IP. For a university environment that encourages commercialization and entrepreneurship with industry–sponsors (or incubatees) it is ideal to allow the incubatee an opportunity to retain ownership of IP or first rights to a royalty-free exclusive license of the IP. Following the discussion of Chapter 2 regarding IP, the EEC attempts to facilitate the incubatee IP agreement with the ILO upon: (i) transparent policies regarding the ownership and commercial right to use the IP, and (ii) flexibility to allow for alternative terms of agreement. Two scenarios will be discussed that represent potential typical scenarios to conduct research through interaction of the EEC and U of S.

If the incubatee wishes to pursue traditional university research avenues and not pay for the laboratory and research costs, the incubatee will agree to give up IP ownership of any new discoveries in return for an exclusive first right to license the IP at an industry standard rate. In this scenario the university and researchers are the owners of the IP and the incubatee can exclusively license the IP for commercial use but the incubatee also escapes some cost and does not have to directly pay for the laboratory equipment and services.

In the second scenario, the incubatee will pay for the laboratory equipment and services. The incubatee will use standard laboratory cost rates determined by research services and the specific laboratory facility manager to pay for research costs. For payment of the research cost, the

⁹ Note the equity amount may seem low but it is use as an example. The EEC will have the ability to negotiate any equity amount with the incubatee as discussed later in the case study of Chapter 4.

incubatee will receive the right to an exclusive royalty-free licensing agreement for commercial use of the IP.

For the ILO to accommodate this model and remain within the effective practices noted for commercialization, it must provide the incubatee with transparent agreements for at least the two scenarios described above.

3.4 Chapter Summary

Chapter 3 aimed to integrate the successful practices that were researched in Chapter 2 into a commercialization model that facilitates industry entrepreneurs to engage the resources of the College of Engineering and the surrounding community. The commercialization model is developed within a five-stage process including idea generation, preliminary feasibility, full feasibility, business planning, and business start-up. Implementation of the commercialization model is through a business incubator identified as the Engineering Entrepreneurship Center (EEC). Research suggests that the structure of a for-profit private owned business incubator may be most effective for the desired result of new business creation. The EEC is a virtual incubator with three employees and a volunteer Board of Advisors. The purpose of the EEC is to provide services to the incubatee businesses through the commercialization model and engage the resources of the College of Engineering and surrounding community. Several resources are identified in this Chapter that are available to support the incubatees within the commercialization model. Chapter 4 will aim to illustrate the potential feasibility of the commercialization model and the EEC through a case study with an industry entrepreneur and feedback from the conceptual participant stakeholders.

4.0 Illustrative Case Study for Commercialization with the EEC

This chapter is an illustrative case study to describe the conceptual interaction of an entrepreneurial industry-sponsor that is interested to pursue the commercialization of a technology with the EEC. Eneray Sustainable Structures (Eneray) is a prospective business and the entrepreneurial industry-sponsor or incubatee in this illustrative case study.

The intent of the following illustrative case study is to determine if the EEC commercialization model is a feasible means to support an entrepreneurial industry-sponsor such as Eneray. To demonstrate feasibility, the case study will illustrate the conceptual participation and interaction of Eneray with the EEC. The interaction with the EEC will inherently bring together several stakeholders to collaborate with Eneray. The following discussion identifies the stakeholders as they conceptually support Eneray's commercialization through the EEC. The stakeholders will be a critical part of this illustrative case study by indicating their willingness to participate with the EEC and the commercialization of Eneray. The stakeholder's willingness to participate will be an indication of value. For the EEC to be successful, value should be apparent for all stakeholders. The case study vis-a-vis stakeholder feedback may also identify potential areas for future improvements to the commercialization model. The illustrative case study to follow in this Chapter will describe the conceptual participation of stakeholders and the feasibility to facilitate the commercialization of Eneray through the EEC.

4.1 The Eneray Business Idea

The prospective Eneray business is for a precast manufacturing plant that uses High Performance Fibre Reinforced Concrete (HPFRC) to produce products for various infrastructure applications. The potential areas for product application are for short span bridges and cladding for building exteriors. The Eneray founders, Michael and Ben, have some experience in entrepreneurship and commercial construction but have also identified a need for support with commercialization and the potential for the EEC to add value through collaboration. The following section will describe the support that Eneray conceptually receives for commercialization through the EEC.

4.2 Eneray Idea Generation

The first stage of interaction with the EEC is the generation of a business idea as described in the flow chart of Figure 15.

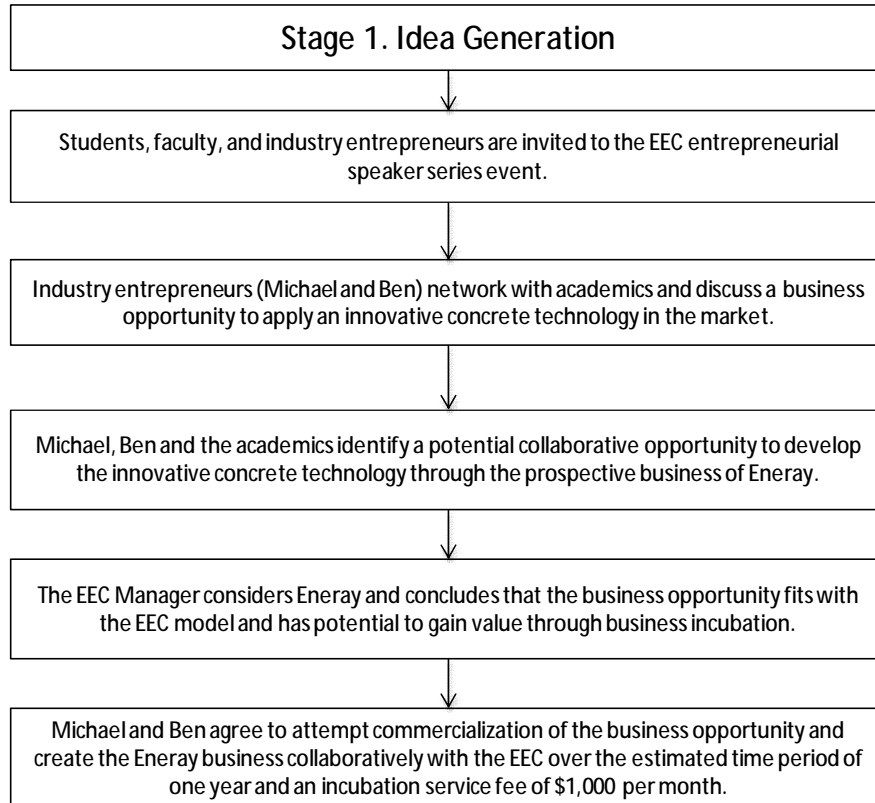


Figure 15: Idea Generation with Eneray

Michael and Ben (the future Eneray founders) are innovative industry people who have made careers in consulting, contracting, and other entrepreneurial endeavors. They represent the first stakeholder to be identified in this case study as the *Industry Sponsors*. Michael and Ben have been invited as guests to the EEC speaker-series networking event where they interact with academics and discuss areas in industry that they have identified for innovative technology application. An opportunity is identified for Michael and Ben to collaborate with academic individuals to develop an innovative technology for industry application through the creation of a new business. The new business idea is for HPFRC products that can be used in various infrastructure applications in the Saskatchewan market. Michael and Ben discuss the potential to collaborate with the academics and the College of Engineering through the EEC. The EEC Manager considers the business idea and concludes that it fits within the target ideas of the EEC

and has potential to gain value through business incubation. Michael and Ben agree upon terms with the EEC to receive incubation services for an estimated time period of one year in return for \$1,000 per month. The conceptual business of Eneray is created and Michael and Ben decide to attempt commercialization with collaborative support from the EEC.

4.3 Eneray Preliminary Feasibility

Eneray begins preliminary feasibility with a conceptual business idea to produce modular precast construction units using HPFRC for various infrastructure applications. Figure 16 describes the steps that Eneray conceptually takes with the EEC to demonstrate preliminary feasibility of their business.

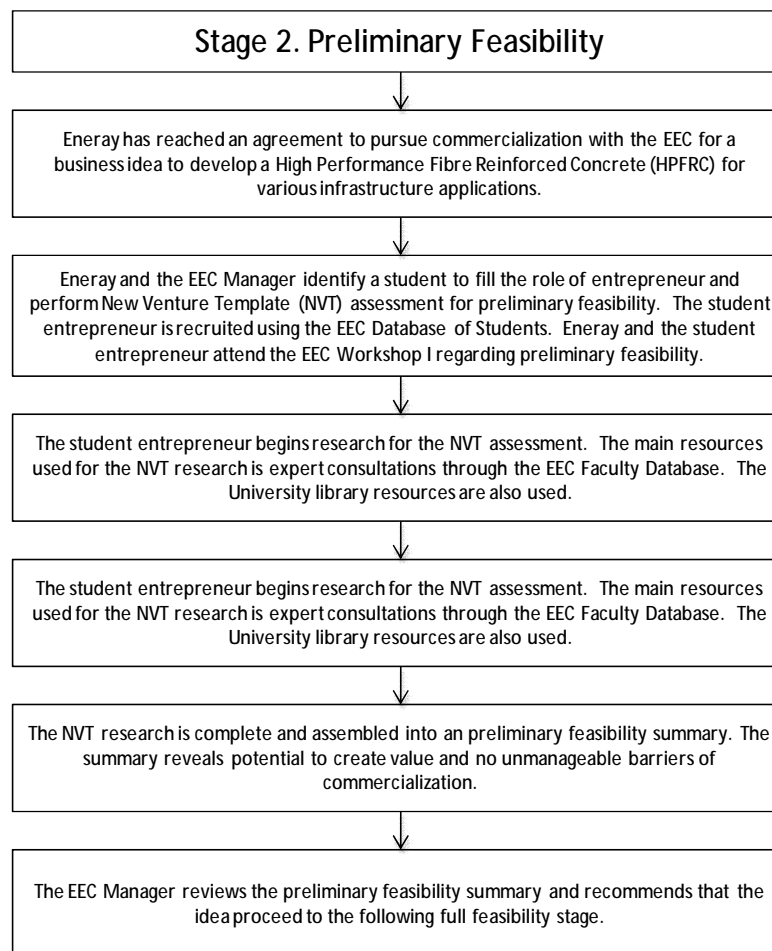


Figure 16: Preliminary Feasibility with Eneray

As Figure 16 describes, Eneray's first step for preliminary feasibility is to use the EEC Student Database to identify an entrepreneur to complete the NVT assessment. Recall that the role of the

entrepreneur, as identified in the commercialization model of Chapter 3, is to perform the preliminary feasibility through an NVT assessment. A student is identified through the EEC Student Database and, after a meeting with the Eneray founders, agrees to participate as the entrepreneur and complete an NVT assessment at no fee but to be considered for future involvement in the entrepreneurial team. This represents the second stakeholder of this case study as the *Student Entrepreneur*. The student entrepreneur has previous experience with the NVT process through an undergraduate course (Commerce 349 – Introduction to Entrepreneurship) and has attended the EEC Workshop I regarding preliminary feasibility. The student entrepreneur conducts the research for the NVT assessment with support for the EEC Faculty Database to confer with academic experts regarding the technical areas of NVT research. The interaction with faculty introduces the third stakeholder identified in this case study as the *College of Engineering Faculty*. The completed NVT assessment indicates (i) no unmanageable barriers to commercialization and (ii) good potential to create future value. However, the NVT assessment also indicates considerable uncertainty in some areas of the business regarding competitor threats, the operations for production, and some general uncertainty and ambiguity regarding the business. This uncertainty can be expected from a preliminary feasibility assessment and this is the purpose for further research in the subsequent stage of full feasibility. Finally, the NVT assessment is summarized in a written preliminary feasibility document and delivered to the EEC Manager for review. The EEC Manager acknowledges that there are no unmanageable barriers to commercialization as well as good potential to create value and thus recommends further study within the subsequent stage of full feasibility. A summary of Eneray's the NVT assessment can be view in Appendix B.

4.4 Eneray Full Feasibility

The Eneray business idea demonstrates conceptual potential for manageable commercialization as well as ability to create value. The next stage is focused to (i) develop a strategy for commercialization and (ii) continue research for commercial value of the business idea in a full feasibility assessment. Figure 17 shows the steps that Eneray conceptually takes to complete full feasibility with the EEC.

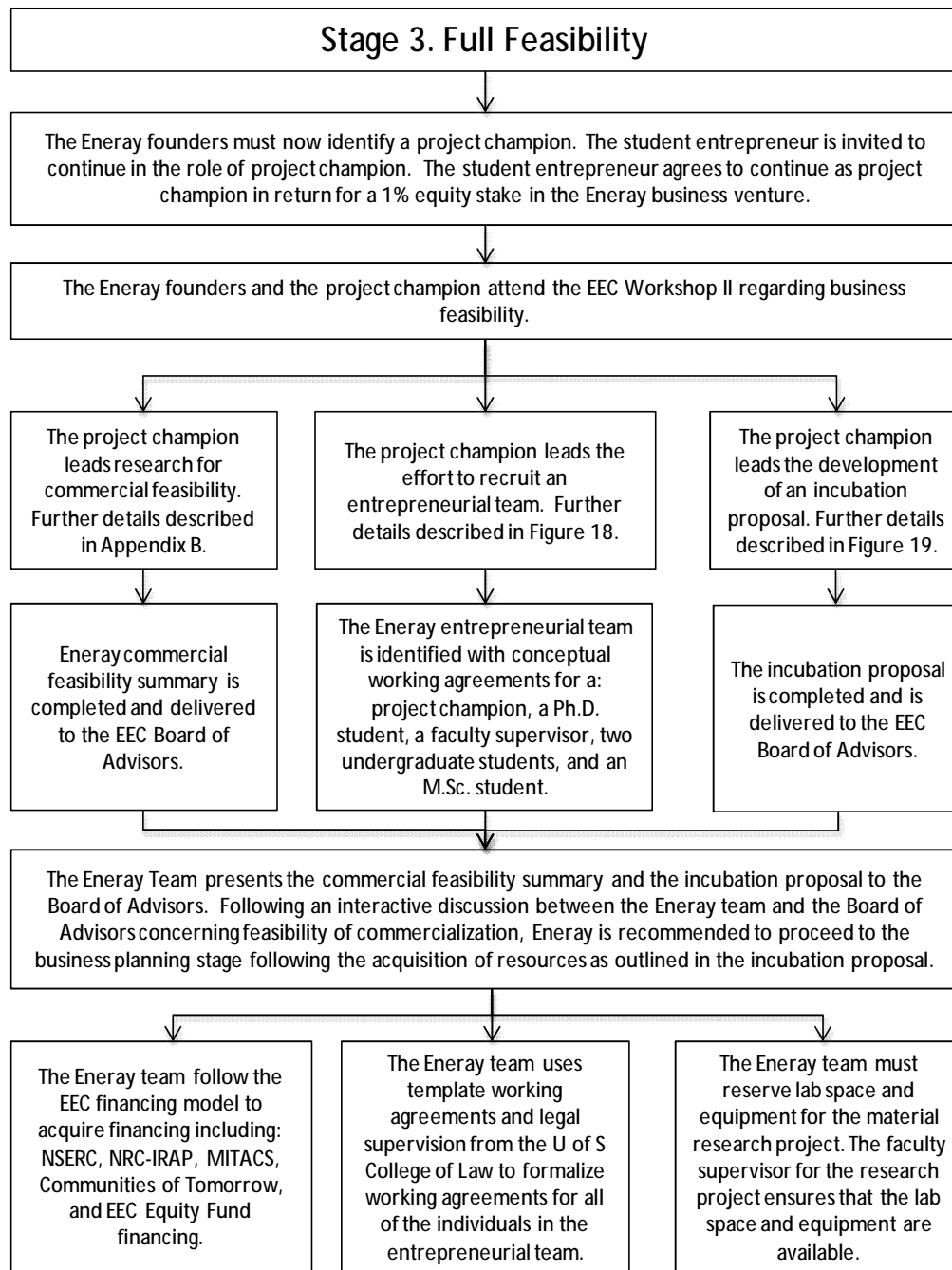


Figure 17: Full Feasibility with Eneray

As illustrated in Figure 17, Eneray first identifies a project champion that will manage commercialization going forward. The *Project Champion* is the fourth stakeholder in this case study. The Eneray founders present an opportunity to the student entrepreneur (introduced in the preliminary feasibility stage) to continue as project champion and receive a 1 percent equity stake in the Eneray business. The student entrepreneur agrees to continue in the role of project champion and completes a MOU with Eneray to define the working terms. The project champion

attends the EEC Workshop II regarding commercial feasibility, incubation planning, and the resources that are made available by the EEC for support during the full feasibility stage. With an understanding of the full feasibility stage, the project champion must next lead efforts to complete commercial feasibility research, build an entrepreneurial team, and develop an incubation proposal.

4.4.1 Commercial Feasibility

The project champion continues research to determine commercial feasibility of the business idea in the areas shown in Table 14 including: product, market/industry, organization, intellectual property management, and finance.

Table 14: Commercial Feasibility of the Eneray Business

	Research Resources	Description
Products	Research is completed using the EEC Database of Faculty to consult for technical feasibility	Bridge Product - Market demand strong / some uncertainty in technical feasibility / potentially long commercialization timeline. Building Cladding Product - Some market demand / technically feasible / short commercialization timeline.
Market & Industry	Research is completed using the EEC Network of Business People to consult and assess market conditions	Industry is mature and potentially resistant to change. Bridges Market: shows strong demand in SK / target audience is rural municipalities and the government / competitors are Laforge and Conforce / differentiation is with competitive capital cost and higher quality. Cladding Market: shows demand in SK / target audience is small to medium sized building owners / Many international competitors such as AlucaBond and Melt Span / Differentiates with high quality and relatively low cost.
Organizational	Organizational capabilities will be assessed using the EEC process to recruit an entrepreneurial team. The organization will also be supported by the networks surrounding the EEC.	Eneray shows the ability to recruit the individuals needed for commercial success. The two founders have 40 years combined entrepreneurial and construction experience. Academics from the U of S will provide the technical know-how. An entrepreneurial project champion has been established. The EEC business networks will provide access to individuals that can collaborate for business success.
Financial	A financial assessment will be completed with support of a financial template that is delivered in the EEC Workshop II.	An abbreviated form of the financials show an estimated 20% profit margin over the first 5 years of sales. An IRR of 89% and a NPV of \$ 3.3 million on \$600,000 of equity investment. The incubation period of 1 year is estimated to cost \$60,000 of which \$35,000 will be leveraged through early stage entrepreneurial financing and a remaining 25,000 will be raised through EEC Equity Fund.
Intellectual Property	The EEC and ILO will support (advise) the developed of an IP strategy for Eneray.	Competitive protection for the Eneray products seems achievable through trade secrets and future patents. The ILO has shown interest to participate in commercialization and Eneray intends to license the future technologies for a royalty of commercial profits. The ILO will also cover the cost of IP protection and laboratory services will be considered research overhead at the university.

Table 14 describes resources that Eneray uses to complete commercial feasibility. A significant resource to the commercial feasibility research, especially for the product research, is the ability

to confer with academics regarding feasibility through the EEC Faculty Database. Consultations with faculty regarding the technical feasibility of the Eneray products indicate (i) the innovative bridge products have good potential to be lighter, stronger, more durable, and quicker for construction assembly and (ii) the cladding products have good potential to be durable, aesthetically pleasing, and thermally efficient. A market assessment for Eneray is assisted by using the EEC Network of Business People and Industry Experts to confer regarding the potential market demand. *Industry Experts* that are part of the EEC Network of Business People and Industry Specialists represent the fifth stakeholder to be identified for this case study. Market demand is assessed for Eneray and indications suggested sufficient demand for a potential 1,100 bridges and thousands of buildings in Saskatchewan. To ensure Eneray has sufficient organizational capabilities, the EEC provides resources to recruit a capable entrepreneurial team. The entrepreneurial team along with the Eneray founders demonstrate sufficient core competency to sustain commercialization and potential to help meet the future needs of the business. Eneray has identified potential to patent the regionally produced HPFRC and to keep trade secrets for some production techniques. Indications seem promising to manage IP of future HPFRC discoveries with the U of S as the Eneray founders have agreed to assign ownership of any discoveries to the U of S in exchange to subsequently license the IP from the U of S for a royalty of commercial profits. *The U of S ILO*, are the managers of University IP and represent the sixth stakeholder identified in this case study. Although Eneray, does agree to allow the U of S to retain the IP ownership of the HPFRC, the ILO must also provide an alternative opportunity for Eneray to receive an exclusive royalty-free license to commercial use of the IP. Lastly, very rough and conceptual financial analysis indicated that a reasonable sales volume and price can result in a financially sustainable Eneray business. To assist the project champion for completion of the financial projections, the EEC provides a financial template within the EEC full feasibility workshop. The project champion then assembles the commercial feasibility research into a written document for evaluation.

4.4.2 Entrepreneurial Team Recruitment

As a parallel effort to the steps for a commercial feasibility assessment, the project champion also takes steps to recruit an entrepreneurial team as described in the flow chart of Figure 18.

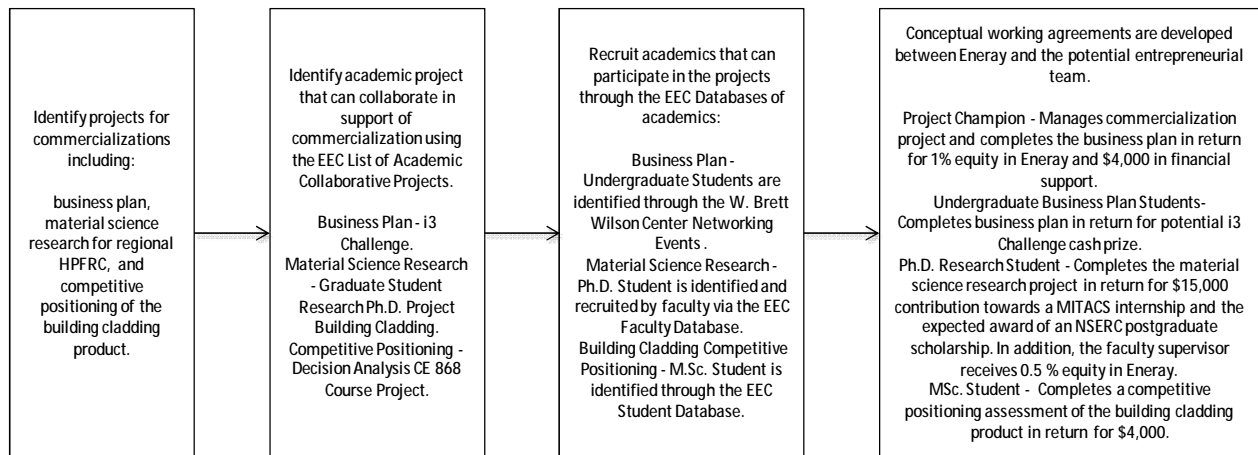


Figure 18: Entrepreneurial Team Building with Eneray

The project champion and Eneray founders identify the projects that are needed for commercialization including: (i) assessing market competitive space for the building cladding product, (ii) material research to develop a regionally produced HPFRC material, (iii) and a business plan to profitably produce the products. Next, the project champion uses the EEC List of Academic Collaborative Projects to identify the potential academic courses and programs to complete these projects: Decision Analysis course CE 868 for the building cladding product, a graduate program research project in Civil Engineering for material science research, and the i3 Challenge for the business plan. Following identification of the academic programs and courses, the project champion uses the EEC Student and Faculty Databases to identify students capable of completing these projects including: a Ph.D. student for the material science research, an M.Sc. students for the CE 868, and two undergraduate students for the i3 Challenge. The *Ph.D.*, *M.Sc.*, and the *Undergraduate Students* represent the seventh, eighth, and ninth stakeholders in this case study. Once the projects and the participant students have been identified, the Eneray founders complete a MOU with the prospective individuals in the entrepreneurial team. The conditions of these working agreements are briefly described in Figure 19 and described in more detail again in the following section regarding the incubation proposal. Following these steps, an entrepreneurial team is assembled with the ability to attempt the commercialization of Eneray.

4.4.3 The Incubation Proposal

As a parallel effort to commercial feasibility and entrepreneurial team recruitment, the project champion also takes steps to managed incubation with the development of an incubation proposal as described in the flow chart of Figure 19.

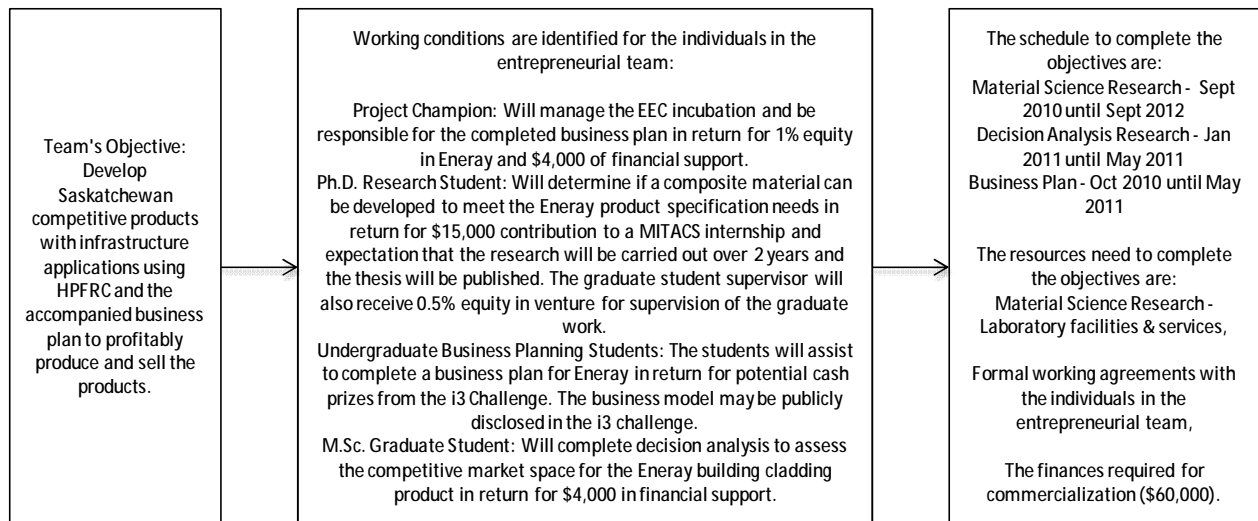


Figure 19: Incubation Proposal with Eneray

As a first step to the incubation proposal, the project champion defines the overall commercialization goal for Eneray to produce modular precast products using a regionally HPFRC material for building cladding and bridge products. Each member of the entrepreneurial team also identifies personal objectives in contribution to the overall commercialization goal. Next, working conditions are detailed for each of the individuals to be involved within the entrepreneurial team. The objectives and working conditions for each of the prospective entrepreneurial team individuals are:

- The project champion will manage the entrepreneurial team and lead the development of the business plan in return for a 1 percent equity stake in the Eneray business and \$4,000 in financial support.
- The Ph.D. student will research the development of a regionally produced HPFRC material within a publishable thesis in return for \$15,000 in financial contributions and the expectation to receive academic research scholarship. The faculty supervisor will also receive 0.5 percent equity in Eneray for supervision. The supervising faculty discloses the equity position within Eneray to the U of S in order to avoid conflict of interest.
- The M.Sc. student will complete decision analysis research to determine the competitive market space for the Eneray building cladding product in return for \$4,000 in financial support.

- The undergraduate students will complete the finance and operations components of the business plan in return for the opportunity to compete in the i3 Challenge business plan competition.

An accompanied schedule and resources are defined to meet these individual objectives as described in Figure 20. These project objectives, schedule, and resources are then assembled in an incubation proposal that outlines a strategy to complete the following stages of business incubation.

4.4.4 Evaluation and Acquiring Resources

At this point of the full feasibility stage, the incubation proposal and commercial feasibility document are complete and ready to be evaluated for graduation to the subsequent stage of business plan development. For evaluation, the commercial feasibility document and incubation proposal are given to the EEC Board of Advisors accompanied by a presentation given by the project champion and Eneray founders for the feasibility of the business. The *Board of Advisors* collectively represent the tenth stakeholder identified in this case study. Following the feasibility presentation, the Board of Advisors recommend that Eneray proceed to the subsequent stage of business planning contingent on acquiring the resources as described in the incubation proposal. The incubation proposal describes resources in individuals, finances, and laboratory equipment that are required for the subsequent steps of commercialization.

Amongst the resources that are necessary to acquire before proceeding to the subsequent business planning stage are the individuals necessary for commercialization. The individuals necessary for commercialization are the prospective entrepreneurial team. To complete the recruitment of the entrepreneurial team, the previously developed MOU need to be legalized within a MOA. Each individual will add conditions of work described in the MOU into a MOA. Standard MOA templates are provided to the incubatee through the EEC. The MOA is formalized under the supervision of a professor from the U of S, College of Law. The *Faculty from the College of Law* represents the eleventh stakeholder to be identified for this case study. With completion of the MOA, the entrepreneurial team is formally recruited and ready to conduct further commercialization of the Eneray business idea.

The second resource to acquire is laboratory space and equipment for R&D of the Eneray products. Eneray requires laboratory equipment and services for R&D of the regionally produced HPFRC material. As Eneray has agreed to assign IP ownership regarding the material research project to the U of S, the laboratory equipment and space are available under regular research project conditions within the Ph.D. research project. However, in an alternative scenario of Eneray retaining full commercial rights to the IP, Eneray would need to assume the cost of the laboratory services. As is the case in a typical research project, the supervising faculty ensures that the laboratory space and equipment are available within the scheduled time period and within the project research budget. With reserved laboratory space and equipment, commercialization can continue into the subsequent stages of commercialization with the ability to perform the necessary R&D for the Eneray products. The last resource to acquire for commercialization is finances to sustain incubation. The EEC will facilitate the acquisition of finances following the EEC financing model in the steps described in the flow chart of Figure 20.

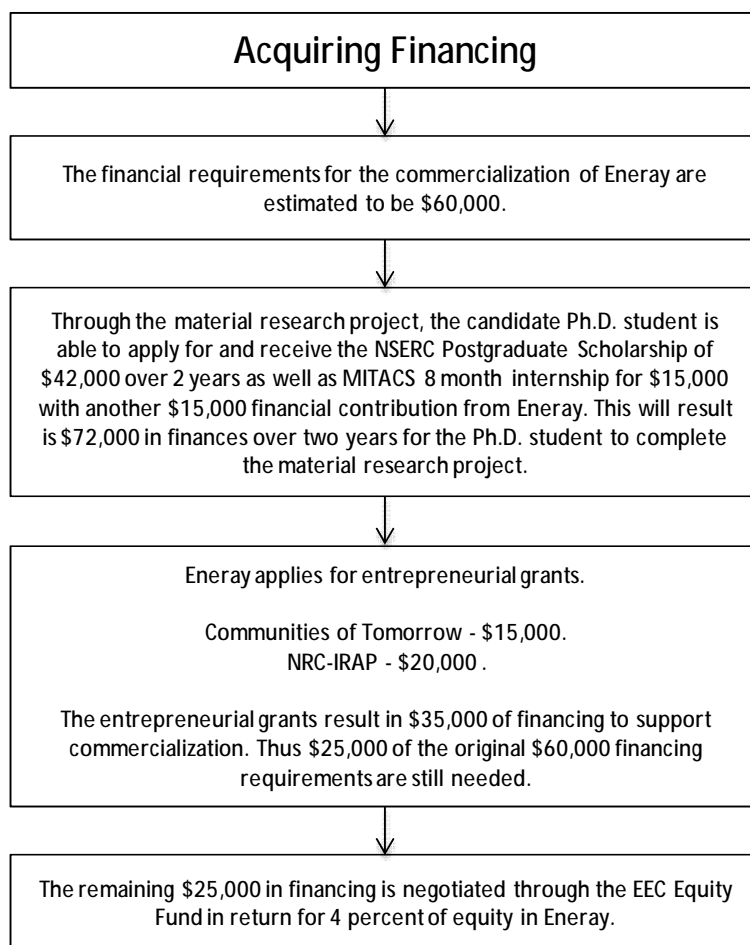


Figure 20: Acquiring Commercialization Finance with Eneray

The first step described in Figure 20 is to identify the financial requirements for the commercialization of Eneray. As describes in the incubation proposal, Eneray requires \$60,000 in finances for commercialization including: a \$15,000 contribution to a financial scholarship for the material research Ph.D. student, \$4,000 for the decision analysis project, \$4,000 for the business plan project, \$25,000 for prototyping and additional expenses, and \$12,000 for EEC incubation fees. Next, scholarships are pursued to support Eneray technology development. The Ph.D. student studying material science applies for the NSERC two year Postgraduate Scholarship in amount of \$42,000 and further for the MITACS eight month internship for \$15,000 accompanied by a \$15,000 leveraged contribution from Eneray. The result is \$72,000 for a two-year material research project. The scholarship and internship contributions support commercialization through research of the Eneray technology; however, these finances do not reduce the \$60,000 required for commercialization. To reduce the \$60,000 cost for

commercialization, Eneray applies for entrepreneurial grants including: \$15,000 for the commercialization of an innovative infrastructure technology through Communities of Tomorrow, and \$20,000 for commercialization cost through NRC-IRAP. With the previously discussed grants, Eneray has acquired \$35,000 of the \$60,000 required for commercialization. The final \$25,000 required for commercialization is negotiated financing through the EEC Equity Fund in return for four percent equity in Eneray. As a result, Eneray has acquired the finances needed for commercialization and is now prepared to continue commercialization through the subsequent EEC stage of business planning.

4.5 Eneray Business Plan Development

Following the full feasibility stage and the strategy developed for the incubation proposal, the next steps of commercialization are to complete a business plan for start-up and continued operations of the business. Figure 21 describes the steps that Eneray conceptually takes to develop the business plan.

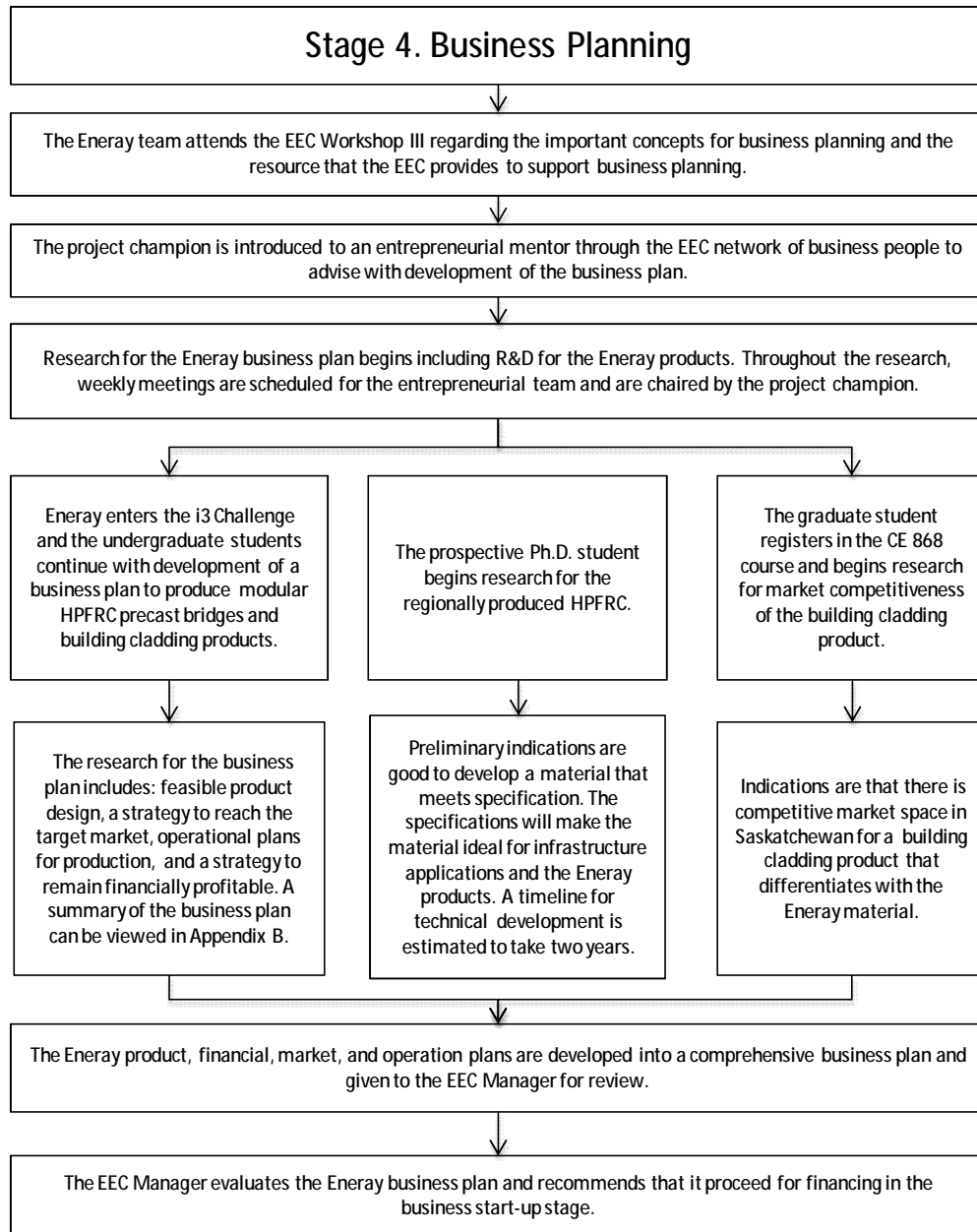


Figure 21: Business Planning with Eneray

The first step described in Figure 21 for the business planning stage is for all the individuals within the entrepreneurial team to attend the EEC Workshop III for business planning. The workshop helps to give the entrepreneurial team a common vision regarding the areas that are important for commercialization and the resources that are available through the EEC for support in this stage. One of these resources is an entrepreneurial mentor that can help advise on business strategy decisions as they arise. The twelfth stakeholder identified for this case study is the *Entrepreneurial Mentor*. The entrepreneurial mentor is available to support the project champion

with guidance for business strategy. For management of commercialization, the project champion organizes weekly meetings with the entire entrepreneurial team for progress updates and evaluation of the business direction. The meetings help to reduce knowledge barriers and encourage the social construct of the team by encouraging each individual to discuss the challenges and direction that are related to their work. The project champion uses the weekly meetings and the entrepreneurial mentorship along with the previously developed incubation proposal for support while completing the business plan and related projects.

The incubation proposal outlines two major projects to be completed, in parallel with the business plan, for product development including: the decision analysis for building cladding, and the material research for a regional produced HPFRC. Research for product development indicates that:

- there is competitive market space for a building cladding product that differentiates with the Eneray HPFRC material.
- research seems promising to develop a regionally produced HPFRC that meets the desired specifications for the Eneray bridge as well as the building cladding products. Research for the regional HPFRC material is estimated to take two years for completion.

The product development projects indicate good potential for technical feasibility of the Eneray HPFRC material along with the market attractiveness for the building cladding product.

As a parallel effort to the product development projects, Eneray enters the i3 Challenge to develop a business plan for the bridge and cladding products. Recall that the project champion and two undergraduate students plan to complete the work for the business plan. The students use the i3 Challenge workshops for support with the development of the business plan. Table 15 summarizes some of the key areas that are strategized in the Eneray business plan.

Table 15: The Eneray Business Plan Summary

	Bridge Product	Cladding Product
Products	The Eneray technology can contribute to bridges that are longer lasting, lighter, less maintenance, and competitive capital cost. The material development for the bridge technology is about 2 years away and thus a short term solution is to license a competitive material from a U.S. distributor.	The Eneray technology is ideal for a cladding product with good aesthetic quality, high durability, and good thermal capability for buildings at a relatively low cost.
Business Model	The business model for eneray is to operate a batch plant for a regionally produced HPFRC and produce modular units for the Eneray cladding and bridge products. The modular HPFRC Eneray products will be sold to contractors for construction assembly.	
Market	<ol style="list-style-type: none"> 1) Potentially 1,100 deficient bridges. 2) Target customer Sask Highways and SK Rural Municipalities. 3) Competitors: Conforce and Lafarge. 4) Product differentiates with longer lifetime and competitive cost. 5) Access to customers through SARM networks to SK Highways. 	<ol style="list-style-type: none"> 1) Potentially 4,000 buildings needing retrofits. 2) Target customer small to medium size building owners. 3) Many global competitors (none regional). 4) Product differentiate on combination of higher-end quality and a low cost. 5) Access building owners through general contracting companies.
Operations	The initial plant will have capacity to complete 12-15 prefab bridges per year. Supply of material will follow just in time inventory. The long term plan - 2012 - a plant upgrade will be made to increase capacity of operation. At this point the Eneray regionally produced material be ready to include in production and reduce COGS. There is a quality control procedure in place and labour costs are factored in at \$20/hour.	The initial plant will produce approximately 80,000 sqft (approx. 8 or 9 buildings) of building cladding product at capacity. The upgraded plant is estimated to have capacity for 200,000 sq.ft. of building cladding. The supply materials will follow just in time inventory. There is a quality control procedure in place and the labour is factored in at \$20/hour.
Human Resources	All key position and core competencies that are required for the Eneray business have been filled and fit with the overall business strategy. Positions including: CEO, COO, Product Managers, Sales Manager, Administrative Executive, and Production Labourers.	
Finances	Estimating a gross profit margin to stabilize at 55% after the first years of growth and a net profit margin of around 20%. In year one an investment of \$600,000 in needed for start up costs and at the end of year two another \$ 3.8 million will be required to expand operations. A conservative case for sales is 5 buildings retrofit and 2 bridges in year one growing linearly to 15 buildings and 6 bridge in year 5. The result is a IRR 89% of the initial investment of and a NPV of \$3.3 million.	

The business plan summarized in Table 15 describes: a business model to produce and sell modular HPFRC prefab products, technically feasible bridge and building cladding products, market demand and a customer base for the Eneray products, feasible operation to produce the products, a capable management team, and reasonable sales forecast to remain financially sustainable. For more detail of the Eneray business plan, an executive summary can be viewed in Appendix B.

The business plan is completed by the i3 Challenge team and delivered to the EEC manager for review. The EEC manager reviews the business plan and recommends that Eneray proceed to the final stage of business start-up.

4.6 Eneray Business Start-Up

Follow the completion of the business plan, the project champion and Eneray founders must next raise the finances needed to begin operations. Figure 22 describes the process that Eneray conceptually takes to acquire start-up capital using the EEC available resources.

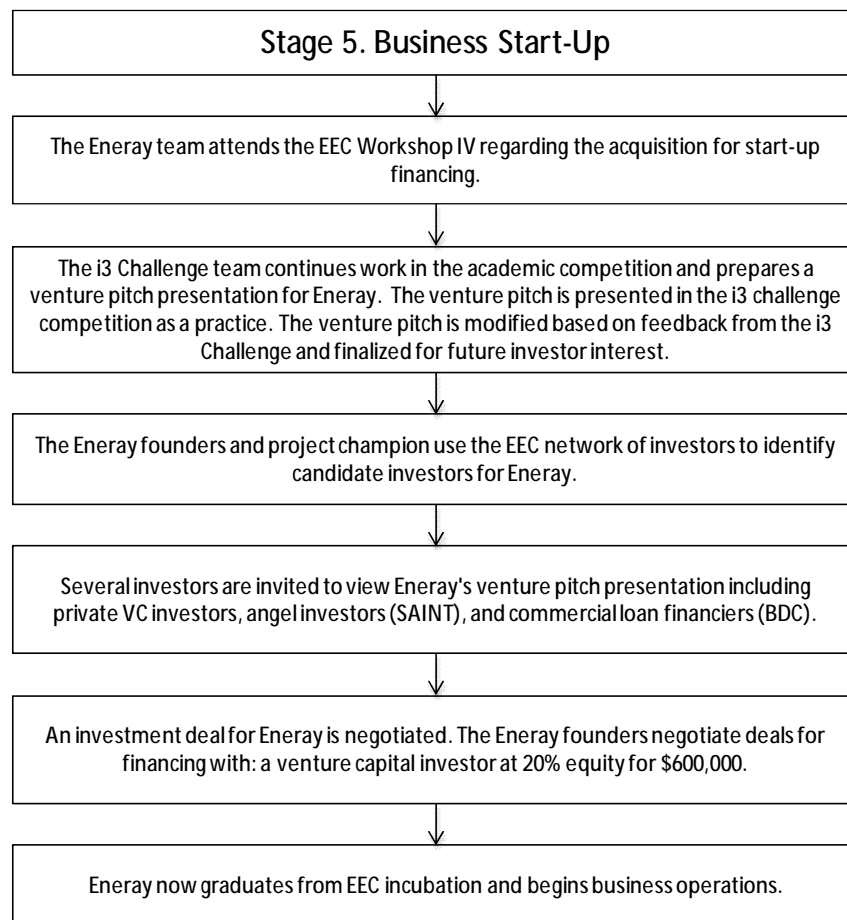


Figure 22: Eneray Business Start-Up

As illustrated in Figure 22, the first step in business start-up is for the Eneray team to attend the EEC Workshop IV regarding the development of a venture pitch and negotiation for start-up financing. As an additional service to support the development of a venture pitch, the business planning team continues work in the i3 Challenge program for mentorship and the development of a venture pitch. The venture pitch is then practiced with real world financiers within the i3

Challenge competition. Based on the response from the practice pitch, slight modifications are made before proceeding with presentation to other potential financiers. With the completed venture pitch, the project champion and Eneray founders identify potential investors from the EEC Network of Financiers. An *Entrepreneurial Financier* will be the thirteenth stakeholder identified in the case study. Several investors are invited to the venture pitch presentation as potential investors including: SAINT investors, private VC's, and commercial bankers. The potential investors are invited to view the venture pitch and Eneray is successful to acquire financing from a private VC. The financing terms are \$600,000 for 20 percent of the company. With the acquired finances, Eneray has now completed the EEC business incubation process and can commence business operations.

4.7 EEC Financial Sustainability

This section of the thesis studies the potential for the EEC to remain financially sustainable as a profit oriented business. To study sustainability, financial forecasts will be developed for the EEC. The projections will be based on the year over year cash flows of the expenses to operate the EEC and the revenues through incubation service fees and equity investments. The EEC expenses and revenues that are included in the projections are described in Table 16.

Table 16: EEC Revenues and Expenses

Expense or Revenue	Description	Estimated Cost
Salaries	Includes salaries for an Administrative Assistant, an Incubation Manager, and a Director for the EEC. The expense also include employee benefits.	Administrative Assistant - \$40,000 per year Incubation Manager - \$60,000 per year EEC Director - \$80,000 per year Employee Benefits - 13% of the salaries
Outsourced Legal	Outsourced legal includes the legal expenses for EEC but not the incubatee business. Legal expenses for contracts including: equity investments, non disclosure and liability, and organizational documents.	The legal cost are estimated to be a base of \$5,000 per year with an additional \$3,000 for each incubatee business.
Outsourced Accounting	Outsourced accounting includes the accounting expense for the EEC but not the incubatee business. Accounting expense include: regular year-end business accounting, and accounting of the EEC Equity Fund.	The accounting cost are estimated to be a base cost of \$8,000 and an additional \$2,000 for each incubatee client.
Marketing	Marketing expenses include: sponsorship and hosting of networking events, workshops, and brosuers.	The estimated cost marketing is \$20,000 per year.
Continued Education	Incudes online webinars, membership with NBIA, and tradeshow/conference attendance.	The estimated cost for continued edcuation is \$10,000 year.
Phone & Internet	Includes internet access and landline for 3 employees as well as two cell phones.	The estimated cost for phone and internet is \$3,000 per year
Rent & Utilities	Rent and utility cost include rent of 1,000 sqaure ft of office space with operating costs (building upkeep) and utility cost (heating, electricity, water).	Rent is estimated to cost \$14/sq.ft. yearly. Operating cost are estimated at \$7/sq.ft. yearly. Utilities are estimated to cost \$1.5/sq.ft. yearly.
Office Equipment	Office equipment includes 3 computers and a printer, 3 desks, 4 tables, 7 chairs, 3 phones and office supplies.	The estimated cost for: chairs is \$100, desks is \$500, computer is \$1000, printer is \$200, office supplies are \$1000, phones are \$50, tables are \$150.
Incubatee Investments	The incubatee investments are early stage EEC equity investments in the incubatees businesses. The investment will typically range between \$10,000 to \$50,000.	The estimated return on investment will follow the financial projections of the Eneray case study. More explanation to follow in the body of this thesis.
Incubatee Fees	The incubation fee is a service fee that incubatee companies pay for the services provided by the EEC. The fee is price to be low and affordable for clients but also to encourage a timely incubation process.	The EEC incubation fee is \$1,000 per month.

Table 16 describes several expenses and revenues including salaries and benefits, legal services, accounting services, marketing services, continued education, phone and internet, office furniture

and equipment, office rent, incubatee equity investments, incubatee service fees, and return on incubatee equity investments. The expenses of Table 16 are rough estimates on what might be expected in the current Saskatoon market. The revenues in Table 16 include service fees as well as equity investments in the incubatee businesses and are speculatively based on a few assumptions that are discussed in the next few paragraphs.

The first assumption regarding the return on the EEC's equity investments is for the number of investments made over the fifteen years forecast. The number of equity investments that the EEC makes with the incubatee businesses will have a significant effect on EEC's revenues as well as a marginal effect on the business incubation expenses. The expense increase is due to the increase in the outsourced accounting and legal work as well as the increased cost of investments in incubatee businesses. Likewise the revenues will increase due to more services fees and potentially more returns from incubatee equity investments. An estimate for the number of incubatee equity investments is speculative but may start at one in the first year and double every year until reaching full capacity of ten investments in the fifth year. This growth projection for the number of incubatee equity investments is used to generate financial projections for the EEC.

The second assumption is for the amount of return that may be expected from the incubatee business investments. The return on incubatee equity investment will be based on the current estimated net present value of Eneray and the probabilistic rate of return for a VC firm's portfolio (based on a statistical study). Eneray's financial analysis estimated a net present value (NPV) of \$3.3 million with a discount rate of twenty-five percent over five years. Assuming that the financiers invest at this \$3.3 million value, statistical averages of a VC firm's portfolio can be used to estimate the EEC's average return in the investment. Using statistical rates of return taken from a research study regarding the IRR over a portfolio of VC investments (Mason & Harrison, 2002), Table 17 describes an expected range for investment returns and the extrapolated returns that can be expected from the Eneray \$3.3 million NPV.¹⁰

¹⁰ It is noted that the \$3.3M valuation of Eneray may seem too large for a start-up business but the NPV is based on detailed financial analysis of the Eneray business plan. There are many methods to calculate a NPV of an business venture and no way to be certain that the valuation used in this exercise is correct. However, the \$3.3M valuation is assumed in this thesis to be a reasonable estimate.

Table 17: VC Return Performance and Eneray Expected Return

VC Performance Profile					
Raw IRR Data (Mason & Harrison, 2002)	0% - Complete Loss	0 - 24%	25 - 49%	50 - 99%	100% or Greater
Approx. IRR	0.0%	12.0%	37.0%	75.0%	100.0%
% of Investments (Mason & Harrison, 2002)	64.2%	7.1%	7.1%	9.5%	12.0%
Five-Year Value of Eneray on \$3.3 NPV	\$0	\$5,815,728	\$15,926,369	\$54,163,184	\$105,600,000
Weighted Average Return Over Investments	\$19,361,191				

The IRR estimates shown in Table 17 are re-categorized from the original publication so that IRR can represent a range of investments. The raw data from publication is shown in the top row of Table 17 and the third row from the top is the rough approximation that are used to calculate the five-year valuation of Eneray.¹¹ The approximated IRRs are used to calculate expected five-year valuations for the Eneray business. These calculations are demonstrated below for the five-year valuation at 12.5% IRR.

Equation 1

$$F=P(1+R)^n$$

Where F = The Future Value of Eneray

P = The Present Value of Eneray

R = The Rate of Return

N = Number of Years

$$F = 3.3 * (1 + 0.125)^5 = \$5,964,707$$

Using the calculated five-year valuation for each of the categories of IRR and the corresponding percent of the investment portfolio, the weighted average return of investment can be calculated. The equation to calculate weighted average is:

¹¹ It is noted that the IRR of Table 17 are rough approximation and not exact. However, the approximations are slightly conservative and report IRR that will result in lower five-year valuations for Eneray. The conservative IRR are due to reporting a complete loss for the bottom tiered 64.2 percent (when the raw data indicates that the venture will be at some loss but potentially not a complete loss) and the top tier 12.0 percent that indicate a 100 percent IRR (when the raw data indicates that the IRR is somewhere at or above 100 percent IRR).

Equation 2

$$X_w = \frac{\sum_i^n x_i w_i}{\sum_i^n w_i}$$

Where X_w = the weighted average return of investment

x_i = the investment return for a given range of investments

w_i = the specified range of investments

$$X_w = ([0*64.2\%]+[\$5,815,728*7.1\%]+[\$15,926,369*7.1\%]+[\$54,163,184*9.5\%]+[\$105,600,000*12.0\%])/ (64.2\%+7.1\%+7.1\%+9.5\%+12.0\%)$$

$$X_w = \$19,361,191$$

Table 17 shows the weighted average for the five-year valuation of Eneray to be \$19.36 million. Of this \$19.36 million valuation it is assumed that the EEC will take an average equity stake of 4 percent but this may vary as the EEC Director negotiates that equity investment with each incubatee. As part of the negotiation for the 4 percent equity stake in Eneray, the EEC makes a \$25,000 financial contribution to commercialization costs as described in Figure 21. The 4 percent equity stake will result in an average expected return of \$775,651 from the equity investments based on the five-year valuation of Eneray. Financial projection are developed for the EEC as illustrated in Figure 23 using the assumptions for the number of incubatee businesses, the expected return on investment from Eneray, a 4 percent equity stake in Eneray¹², and the expenses and revenues listed in Table 16.

¹² The financial projections in Figure 23 also assumes a sale exist for the Eneray venture (i.e. IPO or sales to a corporation) and complete cash inflow of the equity stake to the EEC from the incubatee business.

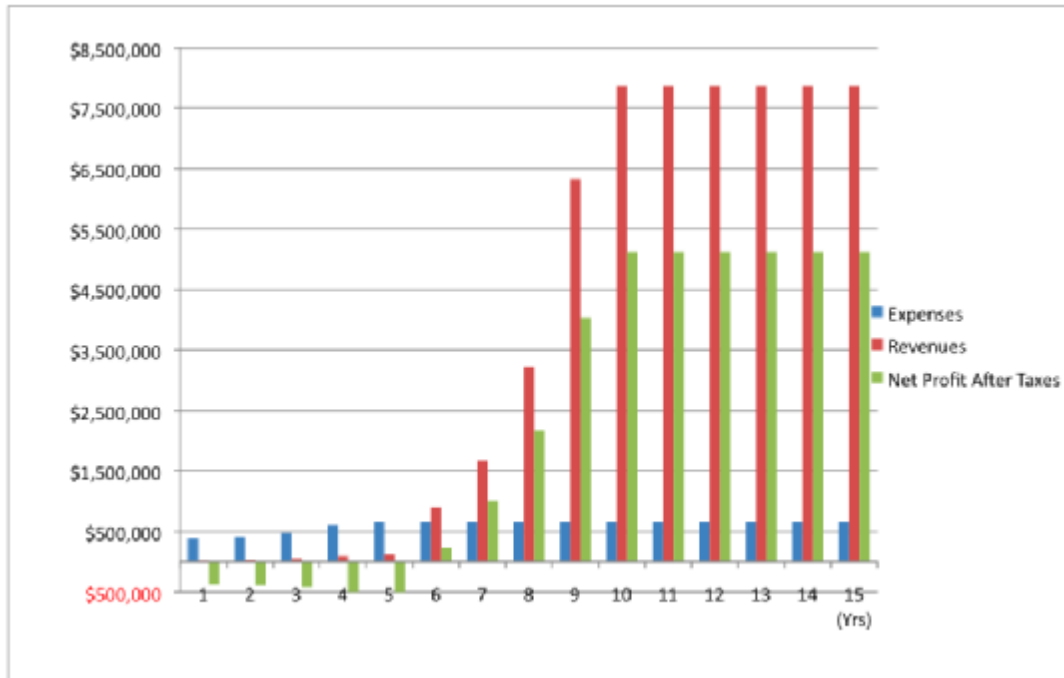


Figure 23: EEC Fifteen Year Financial Projections

Details for the financial analysis illustrated in Figure 23 can be found in Appendix C. A few interesting trends can be identified from the graph illustrated in Figure 23. The first interesting trend to note is the expenses remain relatively unchanged through the fifteen-year projection although they do increase slightly as the number of incubated businesses increase. Second, the revenues increase dramatically in years six through ten as this marks revenue inflow from return on equity investments. The increase revenue in these years is indicative of the critical importance that return from equity investments has for the overall profitability of the EEC. Third, net profit becomes positive in year seven after two years of inflow from equity investments. Seven years is a long period to remain un-profitable but this may be expected as it is estimated to take six years, including one year of business incubation, for the EEC to realize a return from the incubatee business equity investments. If all the EEC's net profit is held in cash, the EEC is projected to have accumulated over \$38 million by the end of the fifteen years. This large amount of cash is an indication of the potential profitability of the EEC to be discussed further in a forthcoming section regarding NPV of investments.

Without a doubt there is some inherent uncertainty in the financial projects of Figure 24. Some uncertainty exists in all revenues and expenses but portfolio theory can be used to illustrate

reduced uncertainty in the most critical component for the EEC's profitability - the return from incubatee business equity investments. One of the fundamental principles of portfolio theory suggests that investing over range of unrelated investments can reduce risk of achieving the expected return for the overall portfolio of investments (Edwin & Gruber, 1998). In this case, the assumption is that each of the incubatee businesses are unrelated (i.e. statistically independent) and the factors influencing success for each business are different. In this sense the high risk of return that can be associated with investing in an individual business is reduced as the portfolio and number of equity investments increase. This suggests that the yearly return for the portfolio is less variable (risky) than the return from each individual incubatee business investment.

The EEC will also have an important factor to help control profitability and the value of return on equity investments. The EEC Director will negotiate equity investment with each incubatee businesses. The amount of equity that the EEC negotiates with the incubatee businesses, will influence the amount of revenue that is generated from the equity investments. Figure 24 illustrates the financial projections for the EEC net profits using alternative 2, 4, and 6 percent equity positions in the incubatee businesses.



Figure 24: ECC Yearly Net Profits with Varying Equity Positions in Incubatee

The most important deduction that can be drawn from Figure 24 is that the EEC can generate a significant amount more revenue through increased equity positions in the incubatee businesses. The net profits for the EEC increases significantly with yearly net profits in year ten ranging from \$2.5, \$5.2, \$7.9 million as equity percentages increase incrementally by 2 percent. The increased net profit demonstrates that the profitability of the EEC is at least partially dependant on the equity negotiation between the EEC Director and the incubatees as well as the success of the businesses.

Following the same financial assumptions as detailed for Figures 24, a \$2.3 million capital investment is needed for financial sustainability and to remain cash positive. This capital investment can come from any number of sources as identified in Chapter 3 including private capital, university, philanthropic, and government. A NPV profile can be used to illustrate the returns for this \$2.3 million investment as described in Table 18.

Table 18: Fifteen Year NPV of the EEC

15 Yrs NPV Profile for \$2,300,000 Investment	
Discount Rate	NPV
30%	-\$1,552,472
25%	-\$953,745
21%	\$0
15%	\$2,402,295
10%	\$6,859,826
5%	\$16,105,093
3%	\$22,259,478
0%	\$35,962,867

Table 18 shows NPVs at discount rates that range up to 30 percent and an estimated IRR for the \$2.3 million investment is 21 percent over a fifteen-year period. This IRR is calculated using the Equation 1 cited earlier in this section and solving for the rate of return R.

$$\$2,300,000 = \$38,262,867 / (1+R)^{15}$$

$$R = \text{IRR} = 21\%$$

In the calculation above, the \$2,300,000 is the initial investment in the EEC and the \$38,262,867 is the accumulated net profit after fifteen years of operations taking into account the time value of money and using a three percent discount rate for inflation. The detailed calculation for the fifteen-year net profit can be viewed in Appendix C.

In addition the expected IRR for the EEC, an investor might be interested to know what average return from incubatee equity investment is required to break-even. To complete this calculation, Equation 1 will be used with the same investment value of \$2,300,000, a rate of return of 3 percent (as adjusted for inflation), a time span of 15 years, and solved for future value of the business. The calculations are as follows.

$$F = \$2,300,000 (1 + 0.03)^{15} = \$3,583,325$$

Using the \$3,583,325 future value of the ECC to break even and the same inputs to calculate the fifteen-year net profit of the EEC, but leaving the revenue from equity investments as a variable, the break even value for equity return from the incubatee can be calculated. These calculations are too detailed to show in the body of this report but are carried out in a detailed excel spreadsheet as shown in Appendix C. The excel spreadsheets calculations indicate that the incubatee equity investment will need to return a value of \$123,094 in order to generate a break even. This represents a significant margin for the EEC to remain profitable as the difference between the forecast return on investment is (\$775,651 as calculated for Figure 23) and the break-even return on investment (\$123,094) is substantial.

It is acknowledged that the modeling methods used in this financial exercise, to use one forecast for incubatee return on investment (Eneray) and extrapolate out for others, is not a completely realistic scenario for the EEC. Although efforts were made to forecast the most likely financial returns for the EEC, the methods used in this modeling exercise do introduce a certain amount of uncertainty in the financial forecasts.¹³

In the next section regarding participation of stakeholders, the financial projections along with the potential return on investment will be presented to potential investor representatives including: *the College of Engineering Dean, Government Representatives, and a Private Venture Capital*. Each of the potential financiers for the EEC represents the fourteenth, fifteenth, and sixteenth stakeholders in the case study.

¹³ The financial forecasts for the EEC were constructed to demonstrate a plausible scenario for the sustainability of the EEC. However, there may be opportunity to go further in future research and integrate risk, uncertainty, and sensitivity in aim to establish a more reliable financial forecast for the EEC.

4.8 Stakeholder Feedback

This section of the thesis summarizes feedback from the stakeholders potentially involved in the illustrative case study. The stakeholders are the individuals that are necessary to be involved with the EEC for feasible operations of the commercialization model. For the case study example, the stakeholders include: Industry Entrepreneur, Student Entrepreneur, Project Champion, M.Sc. Student, a Ph.D. Student, Engineering Faculty, an ILO Representative, an EEC Advisor, an Industry Expert, a Law Faculty, an Entrepreneurial Mentor, an Entrepreneurial Financier, an Venture Capitalist, the Dean of Engineering, and Government Representatives. The stakeholders are to give feedback on conceptual willingness to participate as an indication of the value received through involvement. The stakeholders are also further asked to give feedback and suggestions for opportunities, strengths, threats, and weaknesses regarding their conceptual participation.

4.8.1 Stakeholders Conceptual Participation

To receive feedback, the stakeholders are presented the case study as illustrated in section 4.2 through 4.7. The illustrative case study was presented to the stakeholders within a meeting with the author of this thesis. The intention of the meeting was to ensure that the stakeholders understood their conceptual participation in the case study. The stakeholders were then given a booklet or a presentation of the figures and tables in section 4.2 and 4.7 as an illustration of the case study. The stakeholders are then presented the question: “What is the likelihood that you would participate in a program such as this if the opportunity presented itself? If you would not, why?”. The feedback for each stakeholder regarding willingness to participate is summarized in Table 19.¹⁴ Table 19 identifies the stakeholders by a number in column 1 that represents the order they were introduced in the discussion of section 4.1.

¹⁴ It should be noted that some feedback from stakeholders was given verbally and some written. In this sense, some of the responses in Table 19 are given as word for word quotations and some are paraphrased. All responses listed in Table 19 are intended to represent the responses of the stakeholders as accurately as possible.

Table 19: Participation of Stakeholders

Stakeholder	Capacity of Involvement	Indication of Participation
Industry Sponsor (1)	Brings business idea to the EEC for commercialization. Contributes finances and equity to participants of commercialization. Involved at every stage of commercialization.	I would definitely consider it, depending on the project, the level of help I needed and the right personal fit. It is a great program that would especially benefit a startup or someone new to business development.
Student Entrepreneur(2), M.Sc. Student (8), Project Champion (4)	Involved through the EEC Student Database. Participation includes managing the incubation process, completing NVT assessment, completing a business plan, and completes course work for decision analysis project. Receives equity and financial support for involvement.	I think it is very likely that I would have participated in a program like this, had it been an option. Not only do you gain practical experience in business planning, students potentially get a share of the new business and industry contacts. I think it would be a great learning experience, even if the business turns out to be unsuccessful.
College of Engineering Faculty(3)	Involved through the EEC Faculty Database. Give technical expert advice to the entrepreneurial team. Receives equity for participation.	Yes, I would conceptually participate in the capacity described within the Energy Case Study and do see value for faculty to be more involved in these projects.
Industry Expert & Business Person (5)	Participates through the EEC network of business people. Give expertise in on industry and market related areas.	Yes, I would participate if the opportunity presented itself. I often participate in a role such as this and the only time I would not participate is if the project were not related to my industry.
U of S - ILO (6)	Administers working agreements for IP ownership in research related projects.	There is potential to participate in some scenarios but is unlikely to grant a royalty-free license to the industry-sponsor. The ILO did not comment regarding whether the EEC could provide potential value from the ILO's perspective. It is also noted that the ILO representative may not accurately represent the ILO's interests.
Ph.D. Student (7)	Involved through the EEC Student Database as part of the entrepreneurial team and conducts a research project. Receives financial support.	This is really a great idea. I will participate in this program from my intent. But it really depends on how much time I will put on, because I am really busy doing my research and other things. The only concern is the potential time constraints.
Undergraduate Student (9)	Involved through the EEC Student Database as part of the entrepreneurial team to help complete a business plan. Receives a project for participation in the i ³ Challenge.	I would most definitely participate in a program like this; especially if I could use the business plan for Comm 447. My only concern would be the extra time and effort. The issue being simply the large course requirements for Engineering students in their final years. However, if the team working on the business plan were large enough and the time requirements reasonable, I'm sure I would not have a problem fitting it in. As a student enrolled in the EEO I have a strong interest in business and an opportunity like this would be very appealing to me. I think the potential learning opportunities this program presents through the training courses and practical experience of the people who I would be working with is also an attractive selling point.
EEC Board of Advisors (10)	Participates as a board member and responsible to meet a quarterly meetings.	Yes, I would participate and would support the EEC concept.
College of Law Faculty (11)	Oversees the legalization of working agreements for the entrepreneurial team.	No, I do not see an opportunity for College of Law Faculty to participate as they are not insured to practice law.
Entrepreneurial Mentor (12)	Available to support the project champion during the business planning stage.	Yes, I would participate in the capacity of a mentor. The only condition would be that the relationship between mentor and project champion is healthy.
Entrepreneurial Financier (13)	Involved through the EEC Network of Financiers for availability regarding opportunities to invest in incubatee businesses.	Yes, I see a real opportunity to finance start-ups that go through a process like this. However, one condition is that the IP is not owned by the University and that the relationship with the individuals running the start-up is healthy.
Venture Capitalist (16)	Potentially involved in financing the EEC.	Yes, I see the EEC as a benefit to a VC Firm that focuses in financing start-ups. The EEC could be a due diligence tool for the VC firm and help pipeline potential start-ups for investment.
College of Engineering Dean (14)	Potentially involved in financing the EEC. Must endorse the idea of the EEC.	Yes, this addresses a need for the College of Engineering and fits with the goals of the College.
Government Representative (15)	Potentially involved in financing the EEC.	No, although there is potential benefits to the EEC, the federal and provincial governments do not invest in for-profit entities.

Further to the information described in Table 19, the feedback for the ILO Representative was too detailed to reasonably describe in Table 19 and is thus described as follows.¹⁵

“In the context of research projects that are brought to the university from industry-sponsors with a goal to use the research findings for commercial purposes, there are no documented standard types of agreements for the U of S but there are policies that guide the development of the formulation of fairly standard agreements that can be completed within an amount of time dependent on the complexity of the technology and the situation as well as the dynamics of the people negotiating. The policies that U of S follow are similar to those listed with the follow link <<http://www.lesusacanada.org/StandardPatent>>. The following two paragraphs describe how IP may be managed in the university environment for two types of scenarios.

Scenario 1 of the commercialization model, the industry sponsor brings a research project to the university but does not cover the cost of the research. These projects can sometimes take the path of a normal M.Sc. or Ph.D. project. It is usually the case that outside research funding can be integrated to cover the cost of research and this can alter the negotiation. Anything is negotiable of course; it depends what else the industry-sponsor brings to the table. Maybe the industry partner can negotiate the rights to the IP. It’s good to have an industry partner involved; they may be the ones to transfer the knowledge to usefulness. However, the university cannot afford to do things for free.

Scenario 2 of the commercialization model, the industry-sponsor brings a research project to the university and covers the cost of the research (no original IP belongs to sponsor). At this early stage before the research starts, negotiating an agreement for future use of IP that is undefined is difficult to develop and very time consuming. Instead the IP ownership of any potential new discoveries will remain with the university as they are discovered by university faculty and then potentially negotiated for a license to the industry-sponsor at a later date once the IP is defined and there is an understanding of what is being negotiated. Although it is difficult, there is some opportunity to reach an agreement at the pre-research stage to negotiate a license for commercial use of the IP but there would need to be compensation given by the industry-sponsor.”

Following this feedback from the ILO Representative, it would seem that there is flexibility in the University agreements to manage IP with an industry-sponsor; however, the university will in all cases retain ownership of IP discovered in the course of sponsored research and at the pre-research stage there will be uncertainty regarding the conditions to license the commercial use of IP.

Table 20 describes willing participation by the majority of the stakeholders regarding conceptual participation in the case study. Only the Law Faculty and the Government Representative see

¹⁵ It is noted that this is the perception of an individual that is affiliated with the ILO and although the information to the best of knowledge is accurate, the feedback from the ILO representative does not formally represent the view of the ILO of U of S.

major barriers to participation. In addition, it seems the ILO through administration of University policies, would limit the ability of the commercialization model to operate as intended. The ILO describes rigid policies concerning IP management (described further in the IP feedback from stakeholders) that will limit ability of the industry-sponsor to manage their IP; however, some entrepreneurial projects including the case study example could function within the current policies of the University and ILO. Considering all perspective described in Table 20, the EEC and commercialization model does seem feasible to a degree as (i) the ILO does provide some (although limited) ability to work with the EEC; (ii) the legalization of the working agreements in the MOA can be completed using contact legal assistance rather than of U of S Law faculty; and (iii) there are investors outside the Government Representatives (such as private VC type investors) that can financially sponsor the ECC.

4.8.2 Stakeholders SWOT Feedback

In addition to the stakeholder's indications of willingness to participate, they were also given an opportunity to make suggestion for improvement of the commercialization model through the participation of a SWOT assessment. After the case study presentation to the stakeholders, the question is given: "Can you identify any strengths, weaknesses, opportunities, or threats related specifically to your conceptual involvement with the program?"¹⁶ Some the feedback from stakeholders refers to specific opportunities, threats, weaknesses, and strengths but some are deduced from general feedback from the stakeholders and identified as such by the author of this thesis. To discuss the feedback from stakeholders, the comments are categorized under sub-heading related to the fundamental areas that were identified in Chapter 2 as important for the commercialization model including: Participation of Academic Individuals and Laboratory Facilities, Networks and Community Involvement, Intellectual Property, Entrepreneurial Financing, and Commercialization Process and Management. In addition, a sub-heading is also included for feedback related to the structure and strategy of the EEC. Each of the sub-headings follows the format to list the strengths, weaknesses, opportunities, and threats identified by the stakeholders and follows with a discussion. The stakeholder comments are cited out of context in

¹⁶ It should be noted that some of the responses were given in writing from the stakeholders and some verbally. Although the responses from the stakeholders are in quotation marks, the responses are not an exact word for word responses.

the following discussion but a more detailed description of the feedback from each stakeholder can be viewed in Appendix D.

Participation of Academic Individuals and Laboratory Facilities

Feedback from Stakeholders:

Threat - “It may be difficult to entice involvement from faculty.” - Dean of Engineering

Potential Weakness - “The EEC seems to rely on many databases to identify appropriate students, faculty, and industrial liaisons when required. How are these maintained, and how do you ensure the information is accurate? If you require someone to fill a position, but are unable to identify someone through the databases, what next?” - Project Champion

Strength – “As a student project champion, I would gain practical entrepreneurship experience, likely within my chosen field.” – Project Champion

Opportunity - “To build database of students, you could approach the entrepreneurship classes and clubs (ACE, Could make participation the requirement for GE430 (EEO Capstone), Comm349 and 447, there’s also an Ag business plan class)” – Project Champion

Potential Threat - “Are there potential conflicts of interest when faculty are involved? I’m not sure what the University or professional codes of conduct say about consulting and teaching, but I’m sure that conflicts could arise. How would the EEC address them?” – Project Champion

Opportunity - “I think this process would be a great EEO capstone project, rather than the current business planning/marketing research combination. After taking several introductory business classes, and some intermediate entrepreneurship and business planning classes, EEO students would get a lot of educational value in using their new skills in creating an actual business. In particular, having the student only handle the planning, and relying on the business venture to finance the business would give EEO students the chance to be involved in much larger businesses than they might otherwise be able to.” – Project Champion

Opportunity - “The engineering program at U of S has commerce class first year which outlines the basics of business; however, I think it would be beneficial to have an entrepreneurship class as part of the curriculum in the final year to promote entrepreneurship as a career option for engineers. This class could utilize guest speakers and possibly case studies provided by the EEC and potentially add many more students to your database.” – Undergraduate Student

Strength – “By having undergrads work on these plans, this center may also provide employment opportunities for us and valuable employees for clients. – Undergraduate Student

Opportunity – “The more cash potential for students, the more dedication to the project you will get. Depending on the project, a partial equity share amongst the entire planning group or maybe a consulting fee based on the quality of the plan or success of the business might help.” – Undergraduate Student

Opportunity – “I think it would be necessary to promote the EEC through networking events, emails and class talks similar to what the Wilson Center does. Although many engineers end up either owning or running businesses, I think very few leave university with that as a goal and I think this center/program could present that option to students.” – Undergraduate Student

Opportunity - “It would be good to include feeder courses and programs to collaboratively work with the commercialization model.” – EEC Advisor

Opportunity - “Depending on the product or business you might be able to incorporate part of the plan into the final engineering design projects.” – Undergraduate Student

Opportunity - “There are other entrepreneurship courses on campus, any one of which might be interested in participating in your project. Agriculture in particular might have students who would be interested in this.” – Project Champion

Opportunity - “Is it possible for the ENG 495 students to do a co-op term in entrepreneurship, trying to make a business out of their ideas, but somehow supported by other entrepreneurs in the community?” – Government Representative

Threat - “Are there any deterrents from students participating because of conflicting graduation schedules”. – EEC Advisor

Opportunity - “In the current situation, faculty members feel like industry is not taking full advantage of what they can offer through the university in terms of R&D potential, and they would be thrilled to see that the innovative ideas they have been publishing in the various scientific venues are actually being implemented and benefitting the Canadian industry.” - Engineering Faculty

Opportunity - “Currently, most faculty are not working closely enough with industrial partners to know of their particular problems and offer their help to solve many of the problems they may be facing. On the other hand, many companies are also not even aware of what the university is doing and how it can help them with their R&D projects.” – Engineering Faculty

Strength - “I can receive a good sense of how the result and my research can impact industry. Since I do not have enough business database or information, I’m not capable to give very good business evaluations for this project. I believe this commercialization project would be a great opportunity for me considering the future good cooperation and the potential profits that could be obtained.” – Ph.D. Student

Weakness - “Providing equity to anyone/organization who is not going to be a key contributor (to the ongoing business organization) over the longer term (i.e. beyond the project timeline) may be a flaw in the business model. Most business owners will be loath to give up equity to a person/group who is not contributing to the long-term success of the organization. A better way to compensate is through share option grants; the provision of which are tied to milestones that a person/group must achieve over a future time horizon to ensure that there is value driven back to the organization over the longer term. If for whatever reason the person/group cease to be a contributing member of the business entity (i.e. milestones are not achieved) then their share option grants are deemed void and not exercisable resulting in no further dilution to the business

entity – this make more sense for all participants. In my view value-added services (in exchange for equity) must be proven throughout the business entity's life not just in the early stages.” – Entrepreneurial Mentor

Potential Weakness - Would the University be willing to give lab space and other resources when it is to be used for private commercial research? – Project Champion

Discussion of Stakeholder Feedback:

Many of the comments received through feedback of the stakeholders are related to the integration of academic courses and programs with the commercialization model. The stakeholder feedback identifies the importance of having avenues for academic participation through University courses and programs. The current commercialization model and EEC already have practices to facilitate the integration of University courses and programs within the entrepreneurial team building steps of the full feasibility stage. However, the commercialization model does not specifically identify the courses and programs that are available but leaves the planning to each individual entrepreneurial team. In this sense all the courses and programs identified by the stakeholders can be facilitated to some degree to engage the commercialization model and no immediate changes are necessary. The degree of engagement with the commercialization model will depend on the requirements of the course and program in question. In addition, the stakeholders identify the potential opportunity to improve programs such as the EEO through engagement of projects within the EEC. There could be a mutually beneficial opportunity for the EEO as well as the EEC to provide practical entrepreneurial projects for students through an explicit program engagement within the commercialization model.

Several of the stakeholder comments relate to the upkeep and maintenance of the EEC Databases. Most of the comments related to the EEC Databases identify the importance of ensuring that capable academics are available to be engaged in the entrepreneurial projects. EEC Manager is responsibility for continual upkeep and maintenance of the EEC Databases. The feedback from stakeholders identifies several groups and courses that may be viable avenues to recruit academics for the EEC Databases as well as the recommendation to market the opportunities through emails and classroom talks. These practices can be facilitated by the EEC Manager in the current commercialization model and no immediate change is required.

One comment from the stakeholders identifies a potential threat for conflicts that may arise through faculty participation in industry-sponsored entrepreneurial projects. A threat of conflict

is always present in such projects and cannot be eliminated but must be managed (as described in Section 2.7.3). To help avoid conflict it is important to have an environment that is supportive of academic participation in these projects as well as provide some management practices for the academics to follow. As noted by the Dean of Engineering in Table 20, academic participation in these entrepreneurial projects is supported as a mission of the College of Engineering. As well, the commercialization model integrates practices to manage academic conflicts within the full feasibility stage (as described in Section 3.1.3). The threat of conflicts is addressed (to some degree) within the current commercialization model and no change to the commercialization model is evident.

Further feedback from stakeholders concerns the incentive for students and faculty to participate with projects through the commercialization model. The first important point to note is that all three students and one faculty that were included in the case study indicated a strong willingness to participate through their conceptual roles (as noted in Table 20). However, it is acknowledged that these stakeholders do not statistically represent the academic body of the university and certain comments from stakeholders need to be discussed as follows.

One threat is the potential rigidity of student schedules that may limit the ability for students to participate in projects. There is no means to change a student's schedule or the accompanied workload but, the commercialization model does have practices in the full feasibility stage within steps of the incubation proposal described in Section 3.1.3 to help manage and plan for potential conflicts in students' schedules.

Another stakeholder comment and opportunity is a potential membership to be included in the EEC Databases to support the exclusivity and increase incentive to participate. There is no indication of whether a membership tactic could help entice participation but the strategy should be considered in the future development of the EEC.

One last comment from stakeholders and potential weakness is identified through the equity incentives to become involved in the entrepreneurial projects. Equity or fees are identified as an effective incentive for participation; however, a share option grant may be a better avenue for project ownership in the entrepreneurial projects rather than equity distribution as it: (i) presents the opportunity for ownership only if there is value delivered to the business and (ii) no equity

value is earned by the equity recipient until the time of share option execution (i.e. no taxes have to be paid). This share option grant seems to be a more appropriate method to share ownership within the entrepreneurial projects of the commercialization model and strongly considered to be included.

Only brief mention is given from the stakeholder feedback regarding the use of laboratory facilities. The comment relates to the potential threat that laboratory facilities may not be available outside of academic projects. This threat can be neglected as the University has routine methods to conduct sponsored research through the University Research Services. The related weakness to this type of project is that the sponsor usually has to pay for the laboratory facilities used in the project. This type of “sponsored research - pay per use” arrangement is common among universities and no change is required for the commercialization model.

Networks and Community Involvement

Feedback from Stakeholders:

Opportunity - Other organization can be considered to be collaboratively involved with the EEC including: Saskatchewan Trade and Export Partnership (STEP), other research universities, the National Research Council, the W. Brett Wilson Center, SAINT Investors, Springboard West Inc., Communities of Tomorrow, Ideas Inc., IRAP, the Saskatchewan Venture Forward Business Competitions, and TRILabs. – Dean of Engineering, Government Representatives, Industry-Sponsor, and Undergraduate Student

Discussion of Feedback:

Several comments from stakeholders concern potential opportunities to collaborate with other initiatives from the surrounding community. The stakeholder feedback for collaborative participation with the surrounding community is indeed important for the commercialization model as discussed in Chapter 2. Chapter 3.3 lists several organizations from the surrounding community that are ideal for collaboration with the commercialization model including SAINT Investors, Springboard West, the NRC, the Saskatchewan Venture Forward Business Competition, the W. Brett Wilson Center, Communities of Tomorrow, and IRAP. TRILabs, STEP, and other Research universities are organizations from the community that are discussed by the stakeholders but not identified for collaboration with the EEC within Chapter 3; however, these organizations could potentially become collaboratively involved with the EEC in the future. The Director of the EEC is tasked to develop and maintain relations with the surrounding

community, and the organizations mentioned by stakeholders, among others, should be considered for collaborative involvement with the EEC.

Other areas of practice, within the success factor of the commercialization model, that were not discussed by the stakeholders are education of the community and academic body as well as networked connections to entrepreneurial mentors and business people. No conclusions or recommendation can be drawn from the lack of feedback from stakeholders in these areas.

Intellectual Property

Feedback from Stakeholders:

Weakness - “There are potential issues surrounding the management of intellectual property in the university environment. The current IP management policies and the university ownership policies may restrict some industry-sponsors from participating and may be a weakness for the commercialization model and the EEC.” – Government Representative

Threat - “A particular hurdle that often seems to show up with those industrial partners who are aware of what the university can do for them is the issue Intellectual Property (“IP”) rights. In a contract, the University Industry Liaison Office can negotiate stand-alone IP agreements with the sponsor. This possibility to negotiate stand-alone IP agreements does offer some flexibility but many of the industrial partners still seem not to be very comfortable with it.” – Engineering Faculty

Weakness and Threat - “If university owns the IP, considerable risk is added to the investment opportunity within the entrepreneurial investment opportunity” - Entrepreneurial Financier

Discussion of Feedback:

Several of the stakeholders noted potential threats and weaknesses with IP management surrounding the EEC and University environment. The stakeholder feedback suggests that (i) there is significant risk and caution for entrepreneurial investors to invest in business were IP is owned by the University; (ii) no flexibility for the industry-sponsor to retain IP ownership will likely discourage industry participation in research projects; and (iii) there is uncertainty for faculty and industry-sponsors regarding the opportunities and flexibility available surrounding the ownership and commercial rights of IP within industry-sponsored research projects.

The first and second points reflect a potential weakness and threat for the commercialization model from the university’s policies to retain ownership of IP. The first point identifies a threat and potential barrier for entrepreneurs to obtain start-up capital without IP ownership of their core technology. The second point identifies the likelihood that university retention of IP will discourage the participation of industry-entrepreneurs. This deterrent to participation agrees with

the research findings of Section 2.6 that describes university policies regarding the management of IP and the implications regarding the incentives for participation from industry. To mitigate this weakness and threat of university owned IP, a potential solution would be to provide an opportunity for the industry-sponsor to retain ownership of IP (as such is the case for all Canadian Universities overviewed in Appendix A). If University policy allowed the industry sponsor to retain IP, it would clearly give investors the confidence that the business would retain full control over their technology and likely increase the incentives for industry participation in these sponsored research projects. As an alternative and less effective solution, and following practices listed in Section 2.6, University policies could also change to allow the industry-sponsor an exclusive royalty free license of the IP in aim to increase incentives for the industry-sponsors participation.

The third point identified by the stakeholders is an indication that there is a significant amount of uncertainty regarding industry-sponsored research and the management of IP. This feedback seems reasonable for the current University environment as there seems to be guiding policies but no documented standard types of agreements to follow (as describe by the ILO Representative following Table 20). In addition, uncertainty is captured in industry-sponsored research as the university almost always negotiates the conditions related to commercial use of IP with the industry-sponsor after the research project is conducted and the discovery is complete. To mitigate this weakness in would seem necessary for the EEC to work with the U of S ILO to increase the transparency related to industry-sponsored research agreements. There may be opportunity to help increase transparency through the documentation of certain types of agreements. The documentation could be distributed to the faculty and industry-sponsors for a clear understanding regarding the opportunities surrounding the management of IP.

With the limited research in this thesis, it not possible to predict what policies regarding IP management would be best for the U of S; however, it is likely that changes in policies to allow the industry-sponsors to retain IP as well as more transparency for the management of IP with the University would increase the participation of individuals within industry-sponsored entrepreneurial projects. It is recommended that further investigation be given to University policies and the potential for industry-sponsors to retain IP ownership as well as the potential to

increase transparency in sponsored research agreements through typical scenarios or standard types of agreements.

Entrepreneurial Finances

Feedback from Stakeholders:

Threat and Potential Opportunity - “An important component of financing is the fit between business and financier and this would be a decisive factor for financing the business.”- Entrepreneurial Financier

Strength - “I think the EEC could be an excellent tool for developing technology businesses to be ready for start-up financing and potentially assist with the due diligence process before entrepreneurial financing. As a VC, I would see being part of the EEC Network of Financiers as an opportunity.”- Entrepreneurial Financier

Weakness - “The valuation of the business is often a problem in financing start-ups and this is apparent in the case study. There could be more opportunity to develop business valuation of the entrepreneurial venture in the commercialization model. A reasonable or appropriate valuation would be a benefit for the process of negotiating financing with the start-ups.” – Entrepreneurial Financier

Discussion of Feedback:

First, the concept of the EEC is noted as a strength from the perspective of entrepreneurial financiers. The strategic development of new businesses in the commercialization model is identified as a tool for financiers to invest in businesses that have been through a transparent and effective business development process. In this sense the EEC’s commercialization process can be used by financiers as part of the due diligence process for investing in start-up businesses.

Second, a threat and potential opportunity exist regarding the relationship that is established between the incubatees and the entrepreneurial financier. A portion of the financing decision will depend on the relationship between the incubatee and entrepreneurial financier. Currently, the commercialization model has a Network of Financiers and the strategy to develop an investor-investee relationship is reliant upon a broad Network of Financiers available for the incubatee. Currently the relationship between the incubatee and financier is developed in the last stage of the commercialization model; however, there may be an opportunity to introduce this relationship earlier in the process. The introduction to financiers could be established in the business planning stage for the purpose to discuss the concept upon which a financing agreement could be made in the future. This change of the timing of introduction of the incubatee with the financiers could enlighten the incubatees to what may be expected from the investors stand point and help

the incubatees develop a more effective business strategy. In this method, the relationship between incubatee and financier could be established before the time of financing and help with a smooth negotiation.

Lastly, negotiations of financing start-up businesses are often derailed due to a poor valuation of the business and this is a potential weakness of the commercialization model. In entrepreneurial financing, it seems important for the entrepreneur to enter the financing negotiation with at least an understanding of an appropriate market valuation for the business. The current commercialization model has a step in the business start-up stage to develop a financing strategy for the business and this would include a business valuation. However, it would seem there is room for improvement in this area of the commercialization model as it is described by the stakeholders as an important component of the financing negotiation and weakness in the Eneray case study. To mitigate this weakness, the commercialization model could include more assistance to develop a reasonable business valuation. This could include integration of some business valuation specialists that can assist with mentorship and potentially become integrated within the EEC workshop series.

No stakeholder feedback was given regarding access to financing for the incubatees except for the very brief mention regarding the availability of IRAP and NSERC funding that are already included in the commercialization model.

Commercialization Process and Management

Feedback from Stakeholders:

Weakness - “For new or first time entrepreneurs you could add in some evaluation of their core competencies, strengths and weaknesses to determine the level of support they would need and to determine their roles in the company both present and future.” – Industry-Sponsor

Threat - “Where one fits in the mix is the scariest thing to address for an industry-sponsor but is essential for successful business development. Key players, governance and the core purpose of the business are essential concepts that must be addressed. For example, if they are building to sell, then your strategy is completely different than one that is building towards a legacy company.” - Industry-Sponsor

Opportunity - “Presentations by guest speakers regarding market trends and imperfections at the EEC networking events may help to better initiate idea generation.” – EEC Advisor

Weakness - “There may be a weakness in assessing the technical feasibility of the idea. The model could use more assessment for technical feasibility.” - Industry Specialist

Weakness – “If business teams don’t approach the EEC to help plan their business, what happens? Does the ECC have its own idea generation abilities, or is it reliant on outside sources?” Project Champion

Threat/Strength - “Ongoing communication of the incubatee and the entrepreneurial team may be key to success.”- Entrepreneurial Mentor

Threat/Strength - “Recruiting an effective project champion will be key to the success of the project.” – Industry Specialist

Discussion of Feedback:

The stakeholders identify several specific areas in the commercialization process along with related management for potential improvements of the commercialization model. Some of the feedback identifies the importance of practices that are already included in the commercialization model and some feedback suggests areas that new practices can help to support the commercialization process.

The practices that are already included in the commercialization model and noted as a potential threats if neglected are the selection of an effective project champion and practices for effective communication for the entrepreneurial team. The commercialization model includes project management practices that include team communication in Section 3.1.4 and practices for the selection of an effective project champion in Section 3.1.3. Stakeholders identify the importance of these practices and the EEC Manager should ensure that the practices in these areas are completed in the commercialization process. No change is necessary for the commercialization model regarding practices to select a project champion and ensure effective communication of the entrepreneurial teams.

A few new practices are also suggested to improve the commercialization model. First, the stakeholders suggest that there is a potential weakness in lack of a technical screen for in the commercialization process. Technical feasibility is integrated in the commercialization model at the preliminary feasibility stage within the NVT assessment and the full feasibility stage within commercial feasibility of the product. However, a technical assessment is without a doubt an important aspect of feasibility and perhaps a more explicit indication of technical feasibility should be included in the process. A more explicit technical feasibility assessment may be completed through a template tool that ensures the core business technology is feasible. Thus, it would likely support feasibility assessment of the commercialization model to include a technical

screen. This screen would be well suited for the product assessment of the full feasibility stage described in Section 3.1.3.

Second, the stakeholder feedback suggests the possibility of industry and academic presentations at the EEC networking events regarding topics of market imperfections and new areas of technology application to inspire entrepreneurial discussion for the generation of ideas. The suggestion of presentations at the EEC events would intuitively only increase entrepreneurial discussion and potential for entrepreneurial idea generation. Presentations at the EEC networking events can be easily included and should be strongly considered to be a formal part of the EEC events.

Lastly, the stakeholder feedback suggests that there may be a lack of definition for the role of the industry entrepreneur (industry-sponsor) throughout the incubation period and for the future of the business. The commercialization process does not define the role of the industry entrepreneur and allows freedom for differing amounts of involvement. This freedom is included to accommodate for different industry entrepreneur scenarios and desires. The industry entrepreneur may desire to be CEO, or a board member, or simply a contributor to the start of the business. Due to the stakeholder feedback it seems reasonable the role of the industry entrepreneur should be defined and transparently made clear for the industry entrepreneur as well as the entrepreneurial team. One way to keep transparent awareness of the industry entrepreneur role is through project management and meeting at the end of every stage of the commercialization process. The industry entrepreneur can make aware his understanding for the future direction of the business and their potential role as the business strategy is developed. It should be strongly considered to include a meeting at the end of every stage to discuss the roles going forward of the industry entrepreneur with respect to the business.

The EEC Structure

Feedback from Stakeholders:

Strength - “Although there are a number of resources and organizations available to assist startups, the template laid out is uniquely a Saskatchewan approach with strong technical support.” – Industry Entrepreneur

Threat – “It is important to differentiate the EEC and to clearly illustrate the partnerships and affiliations that EEC might have with other affiliated organizations with the network. – Government Representatives

Opportunity - “The design for initial investment in the EEC is interesting and there may be an opportunity for a private public partnership.” – Dean of Engineering

Opportunity and Weakness - “The salaries of the EEC employees could be reduced in effort to reduce the expense of the EEC. An alternative structure for compensation like stock options may be an opportunity.” – Private Financier

Strength - “It is important to keep the EEC as a private organization and separate firm from the University in effort to stay away from bureaucracy and potentially burdensome University policy.” – Private Financier

Strength and Opportunity - “This could be a great financing opportunity for the right private investor. Not only for a return on investment but a screening and due diligence tool before actually making investments in the start-ups. The VC firm could consider an EEC investment as an R&D expense with potential to return some profits. In Saskatchewan, Golden Opportunities or Saskatchewan Works firms may be a good fit to finance the EEC.” – Private Financier

Opportunity - “There may be potential to have an alumni fund to support the EEC at the U of S.” - Government Representative

Weakness/Opportunity - “Further discussions would be needed within the University environment to determine that the EEC is, in fact, something that the University would like to support (in their overall strategy). We would not want to consider funding/developing a project that did not have support from the highest levels of the university and where it had been determined to be one of the universities priorities in terms of funding.” - Government Representative

Discussion of Feedback:

The stakeholders identify several areas for potential improvements to the strategy and structure of the EEC. First, a potential threat is identified in that the competitive space for the EEC is not comprehensively described to demonstrate the differentiation of the EEC from other business incubator type organizations. Potential investors of the EEC would especially be interested to understand the competitive space and differentiating characteristics of the EEC. The EEC differentiates from other organization as a business incubator that specifically focuses on the resources of the College of Engineering in students, faculty, and facilities. In addition, the EEC describes several organizations that have good potential to be collaboratively involved (discussed in Section 3.3). Unfortunately, the research in this thesis does not go to the extent of describing the potential collaborative relationship with these organizations but just that there could be a value share relationship through collaboration. Research to complete a competitive space overview along with a description of the collaborative partnership with the EEC would be informative for potential investors and an intelligent next step in implementing the EEC going forward.

Second, there are several opportunities and weaknesses identified for the potential EEC investment avenues. The government representatives have indicated that their representative programs do not fit the for-profit EEC structure and would not be a likely candidate for investment. The federal and provincial government programs would only consider funding non-profit organizations. The for-profit structure was chosen for the EEC as it has been statistically proven to be the most effective structure to create new businesses (as described in Section 3.2). Government representatives also indicated that a current threat exists for their investment as there is no indication of support from the directional level of the University. Currently the highest level of support is from the Dean of Engineering. There could be potential for government investment but it may not be the most ideal investment avenue for the current structure of the EEC. At a later date, if government investments are pursued, the structure of the EEC would likely need to change to be a non-profit organization and support would need to be given from the directional level of the University.

Third, there may be significant opportunity in private investment for the EEC. The concept of the EEC is noted as a potential strength for investment from a VC type firm as it can be used as a tool to develop business in a transparent and effective process. In this way, the incubatees' participation with the EEC can essentially assist the VC firm in the due diligence process of investment. Golden Opportunities and Saskatchewan Works are two local investment firms identified by stakeholders as potential investment partners for the EEC. Another private investment structure that is identified by stakeholders is a University alumni fund. The fund could provide an opportunity for alumni to invest in an initiative that supports U of S entrepreneurship and at the same time potentially receive a return on investment. It must be noted that there may likely be conflicts with the U of S in receiving funds from alumni as this could potential divert alumni funds from other U of S initiatives. Overall, the private sector VC type firms may be the best fit for financing the EEC but it seems that there are options for different financing structures.

Fourth, stakeholders also identify a strength regarding the private structure of the EEC as opposed to the University operated structure. It is intended that the EEC remain separate from the University organization and privately operated.

Lastly, stakeholders make the suggestions that the salary structure is too high and a weakness for the EEC. The high salaries are a burden to the expense of the EEC and account for nearly half the yearly expenses (as described in Appendix D). The current structure of the EEC is designed to recruit talented individuals to operate the EEC through competitive salaries. However, instead of recruiting talent through high salaries, perhaps incentive can be included in an employee ownership package and possible contracted work with milestone payments. This type of payment structure may be ideal in the early years of the EEC in order to remain lean with expenses and still recruit talent through employee ownership structures and contracted milestone payments.

4.9 Chapter Summary

This chapter describes an illustrative case study with Eneray Sustainable Structures for the purpose of indicating the feasibility of the commercialization model and EEC. The case study describes the conceptual steps that Eneray takes to engage the commercialization model and EEC in the effort to commercialize the business opportunity. Next, a financial model was developed through extrapolating the engagement of Eneray with the EEC to model several incubated businesses and predict the financial sustainability of the EEC. A \$2.3 million investment is expected to allow the EEC to remain cash positive and produce an average IRR of 21 percent over a fifteen-year period. In this illustrative case study, several stakeholders are identified and give feedback for their conceptual willingness to participate. There is a clear indication from the majority of the stakeholders that value is created through the EEC. Two of the fifteen stakeholders (Government and Law Faculty representatives) indicate specific reasons why they would not participate in the case study; however, the commercialization model and EEC is still very likely feasible (to an extent) through alternative avenues of EEC financing and legal support. To resolve the problem of participation from these two stakeholders, government investment is not necessary as other private investment may be more readily available for the EEC and legal assistance can be outsourced rather than coordinated with the College of Law. Although feasibility is very likely, the University policies and management of IP, specifically for IP ownership and lack of transparency in related management, in industry-sponsored research may greatly limit the capacity of the EEC. Lastly, the stakeholders give feedback for a SWOT analysis and identify opportunities, strengths, weaknesses, and threats that lead to potential improvements in the commercialization model and EEC. The potential improvement for the EEC

as identified and discussed in Chapter 4 will be further summarized in the Recommendations Section 5.1 to come.

5.0 Conclusion

The primary goal of the thesis was to develop a commercialization model with likely potential to engage and gain cooperative participation from the necessary stakeholders in order to facilitate the transition of innovative engineering ideas from industry to the marketplace using the resources of the University of Saskatchewan, College of Engineering.

Entrepreneurship is widely accepted as a critical component for an economy and research universities around the world have been evolving to include a ‘third role’ to embrace entrepreneurship in addition to their traditional roles of research and education. Governments and industry have pushed research universities to become more involved with commercialization and entrepreneurship and by doing so many new businesses and products are developed to help drive economies. The U of S College of Engineering has demonstrated ability to create sustainable spin out businesses. However, many of the businesses created in the College of Engineering were developed in an environment lacking in entrepreneurial culture or support. No model exists in the College of Engineering to support entrepreneurship and the development of new businesses; thus, there is a need to research the potential for a commercialization model to support new business development in the College of Engineering.

The first objective was to develop a commercialization model to engage and gain cooperative participation from the necessary stakeholders and to facilitate the transition of innovative engineering ideas from industry to the marketplace using the resources of the College of Engineering. The second objective was to develop a strategy to implement the commercialization model with the U of S, College of Engineering. The last objective was to test the feasibility of the commercialization model to be implemented with the College of Engineering.

5.1 Research Summary

The first objective was completed to develop a commercialization model for the facilitation of entrepreneurial ideas to the marketplace using University resources. The commercialization model is developed to include practices important for university commercialization and early

stage business development including: university intellectual property management policies, access to early stage entrepreneurial financing, participation of academics and laboratory facilities, a commercialization process and related management, and entrepreneurial networks with community involvement. The commercialization model includes these critical areas of practice in a five-stage process including: idea generation, preliminary feasibility, full feasibility, business planning, and business start-up. The result of the commercialization model is an illustrative process with steps and screens to manage and engage important practices for the development of new businesses in the university environment.

The second objective is also completed to develop a strategy for implementation of the commercialization model with U of S College of Engineering. The Engineering Entrepreneurship Center (EEC) is developed to operate the commercialization model through the structure of a privately owned for-profit business incubator that engages the resources of the College of Engineering and surrounding community for entrepreneurial support. The privately operated and for-profit structure of the business incubator is selected as research demonstrates it to be the most effective structure to create new businesses as opposed to traditional university operated or non-profit structures. The EEC is focused to engage academics and industry entrepreneurs to create new businesses and provide an investment return to shareholders. It is a virtual incubator that only provides office space for three employees and has a volunteered Board of Advisors. The EEC is also designed to engage several resources to support the commercialization model including: academics along with courses and programs, laboratory facilities, government and private entrepreneurial financing, networks to entrepreneurial financiers, entrepreneurial mentors, industry specialists, entrepreneurial educational workshops; other entrepreneurial organizations from the surrounding community, and entrepreneurial networking events. The EEC is a virtual and privately operated for-profit business that uses resources of the College of Engineering and surrounding community to support the commercialization model for the creation of new businesses.

The third and last objective to test the conceptual feasibility of the commercialization model to be operated and implemented by first developing an illustrative case study for the EEC and then testing the willing participation from the necessary stakeholders. The illustrative case study was performed and demonstrated the feasibility of the EEC to support the creation of a prospective

business, Eneray Sustainable Structures. The case study illustrated feasible steps for Eneray through the conceptual involvement of several stakeholders to engage the College of Engineering and EEC for the creation of a new business. The Eneray case study was also extrapolated to help forecast the financial sustainability of the EEC. The financial forecasts included equity investments in the incubatee businesses as well as small service fees for the incubatees and other typical business expenses. The EEC was projected to become a profitable business in year seven and steadily see increased profitability through incubatee equity investments revenues. The EEC requires an initial investment of \$2.3 million to remain cash positive and is expected to produce an IRR of 21 percent over a fifteen-year projection.

To complete the last objective, conceptual participants of the Eneray case study, as stakeholders, were used to test the conceptual feasibility of the commercialization model and EEC to be successful. Seventeen participant stakeholders were identified in the case study and asked for feedback for their conceptual willingness to participate. Only two of the total seventeen stakeholders (Government and Law Faculty Representative) indicated that they would not participate in the capacity described in the case study. The Law Faculty Member was not able to participate through assistance with formal legal work as Faculty are not insured to practice law. As well, the Government Representative would not financially sponsor a for-profit business such as the current EEC structure. Alternative avenues of outsourced legal work and other sources of financing can very likely be identified and give a probable scenario for the EEC and commercialization model to be feasible. In addition, the IP management with the ILO and U of S does seem to limit the ability of the EEC and discourages participation for some potential stakeholders. Although the EEC and commercialization model is currently feasibility with current IP management policies at the U of S, there certainly seem to be room for improvement as noted in the recommendation of the following section. All other stakeholders indicated their willingness to participate including: Students, an Engineering Faculty Member, the Dean of Engineering, an Entrepreneurial Mentor, an Industry Expert, an Entrepreneurial Financier, a Venture Capitalist, an Industry Entrepreneur, a prospective EEC Advisor. The willing participation given by the majority of the stakeholders is a clear indication that significant value to inherently involved in a concept of the EEC through projects such as the Eneray case study. In summary, the vast majority of the stakeholder participation and alternative avenues of

participation for the two stakeholders that cannot participate, the EEC and commercialization model demonstrates conceptual feasibility.

The thesis research also allows the stakeholders to give feedback for strengths, opportunities, threats, and weaknesses to improve the EEC and commercialization model. The feedback is considered for potential future improvements of the commercialization model and EEC. The stakeholder feedback guides the recommendations that are summarized in the following Section 5.2.

5.2 Recommendations for the EEC and Commercialization Model

Through the case study and the conceptual participation of the representative stakeholders, several recommendations are made and suggested to be included for future development of the EEC and commercialization model. The stakeholders each gave indications of strengths, weaknesses, opportunities, and threats that are identified through their conceptual participation in the case study. The following recommendations are made for the future development of the EEC and commercialization model:

- i. As part of the continued upkeep and maintenance efforts for the EEC Databases, consider an exclusive membership as an incentive for participation.
- ii. As a part of the continued effort to engage academic courses and programs, pursue the development of a new academic program for participation with the commercialization model's project champion and explicit engagement of the EEO and EEC.
- iii. To pursue private financing opportunities for the EEC through private investment with Golden Opportunities and Saskatchewan Works as a first option and to continue investigating the possibility for alumni to participate through becoming shareholders.
- iv. To use share options instead of equity positions for business ownership incentives of the participants in the entrepreneurial team.
- v. To complete a competitive-space map for the entrepreneurial assistance organization in the surrounding community and describe the partnerships for collaborative involvement with the EEC.
- vi. To include an opportunity for industry and academic individuals to make presentations for market opportunities and technology advancements at the EEC networking events aiming to inspire entrepreneurial discussion.

- vii. To add a technical feasibility screening template to the product assessment in commercial feasibility of the full feasibility stage.
- viii. To include a step at the end of each stage for the industry-sponsor to discuss their on-going role as part of the entrepreneurial project and the prospective business.
- ix. To implement an employee share/ownership program and the potential for contract work in the early years of the EEC for reward-based incentives to complete work tasks while the EEC remains financially lean.
- x. To further investigate University policies and the potential for industry-sponsors to retain IP ownership as well as the potential to increase transparency in sponsored research agreement through typical scenarios or standard types of agreements.
- xi. To include business valuation experts in the business planning stage and focus an aspect of the EEC Business Planning Workshop for effective development of a business valuation.

5.3 Recommendations for Future Research

The following areas were identified as opportunities to further the works of this thesis through future research:

- i. Policies and practices to support an entrepreneurial culture for academic participation in commercialization.
- ii. Research to integrate risk, uncertainty, and sensitivity in aim to establish a more reliable financial forecast for the EEC.
- iii. Research for implications of university bureaucracy and methods to engage university policies and procedures for commercialization.

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Appendix A: University Overview of Commercialization Practices

Research for successful factors regarding university commercialization and entrepreneurship includes an industry overview of successful practices at various universities. An overview of six universities is completed to indicate practices in areas to: gain participation and manage conflict for academics, access university laboratory facilities, build networks for connections to mentors and business people, establish community engagement through support and education, entrepreneurial education of the university community, provide opportunity for entrepreneurial financing, encourage entrepreneurship through IP management, use a commercialization process, and the management of commercialization within industry-academic collaborations. The universities are selected based on their performance regarding the creation of new businesses. The Milken Institute commercialization index for universities is used to select three US and three Canadian Universities. The reviewed universities include: Massachusetts Institute of Technology (MIT), California Institute of Technology (CalTech), University of California San Diego (UCSD), University of Waterloo (U of W) University of British Columbia (UBC), and Simon Fraser University (SFU). To review the universities, information is primarily taken from the respective university websites. As not all information regarding university practices is documented on the websites, the forthcoming review may not be comprehensive. However, a comprehensive review is not required but the purpose of the overview is to determine if universities are ‘in fact’ addressing the areas of practice listed above. Table 21 describes the areas that MIT uses to promote university commercialization and entrepreneurship.

Table 20: Commercialization and Entrepreneurship at MIT

MIT Practices	
Participation of Academics & Lab Facilities	
Participation of Students and Faculty	CRE/MIT is a program that engages student and faculty in industry projects related to real estate - many methods of involvement including student theses. Innovation-Teams is built around a course that connects faculty and students to leading edge research with commercial potential. Industrial Liaisons Program (ILP) is focused to engage faculty and student with the industry clients.
Incentive for Participation	10% of ILP licensing royalties are distributed among faculty that participate in commercialization projects. 20% of faculty time is allocated for such activities.
Management of COI and COC	ILP manages COI and COC. First priority is to the academic institution and all outside activity must be disclosed to the university on a yearly basis.
Use of Laboratory Facilities	MIT Office of Sponsored Programs has standard rates for services offered. There is also cost sharing programs that cover a wide variety of agreements.
Networks and Community	
Surrounding Centers and Community Supporters	Many incubation centers including: Deshpande Centre is a non-profit entrepreneurship centre established by a philanthropic donation the MIT School of Engineering. Cambridge Innovation Centre - Is a business incubator neighboring MIT to provide start-up businesses services to meet the need of a small growing business.
Educating the Public	The Deshpande Centre holds mixers, workshopers, speaker series' as well as other networking and educational events.
Collaborating with Mentors and Business People	The Venture Mentorship Program is an MIT program that's goal is to provide entrepreneurial mentorship throughout campus by connecting VC's, entrepreneurs, faculty, and other entrepreneurial mentors.
Educating Students	MIT Entrepreneurship Center - Educates students in entrepreneurship, establishes alliances to industry, and connects with government and industry. Business Plan Competition - an extra curricular activity that encourages students and researchers to explore entrepreneurship. Many other competitions exist with entrepreneurial focuses.
Intellectual Property	
Ownership policies	MIT retains the ownership of IP generated in all university research projects.
Standard IP agreements	Transparent policies for a variety of alternative agreements exist on the Office of Sponsored Research Project website.
Flexibility to Negotiate Regarding IP Ownership	There is flexibility to negotiate within the research agreements but in all cases MIT retains either joint or full ownership of IP. MIT can allow for royalty free license to industry-sponsor.
Entrepreneurial Finances	
Source, Type, and Stage of Financing	Many competitions provide early stage financing as awards including the MIT Business Plan Competition . Deshpande Center provides two early stages of grant funding for entrepreneurial projects.
Support for Financial Modeling	Indirect support through engaging students in academic project such as the Innovation-Teams .
Principle Sponsor of Center	Desphande was financed by a philanthropic donation.
Stage Gate and Management	
Explicit Monitoring of Industry Academic Working Relationships	No explicit monitoring system is used however management practices are often included in the individual working agreements.
Specific Stages and Gate Through Commercialization	Screening occurs in the grant application process with the Deshpande grants. Each team will define there own commercialization process.

The information described in Table 21 was taken from the MIT university website and related links including: <http://web.mit.edu/>, <http://web.mit.edu/deshpandecenter/>, and <http://web.mit.edu/industry/sponsor-research.html>. Table 22 describes the areas that Caltech uses to promote university commercialization and entrepreneurship.

Table 21: Commercialization and Entrepreneurship at CalTech

CalTech Practices	
Participation of Academics & Lab Facilities	
Participation of Students and Faculty	The Office of Sponsored Research manages agreements where faculty and graduate students become principal investigators for fees paid by sponsors. The Technology Transfer Office have initiatives to engage students and faculty in commercialization and entrepreneurship.
Incentive for Participation	Fees in sponsored research projects. Potential royalty profits through commercialization of intellectual property .
Management of COI and COC	Encouraged to participate in outside commercialization initiatives but cannot compromise their duties to the university. Sabbaticals are often taken during the early stage of commercialization. Each situation is managed individually and requires full disclosure from faculty in situations of outside interests.
Use of Laboratory Facilities	Facilities available for commercialization and start-ups on standard fee for service basis.
Networks and Community	
Surrounding Centers and Community Supporters	Entretec is a non-profit business incubator as a collaborative venture between Caltech and the City of Pasadena. Jet Propulsion Laboratories : a caltech laboratory that focuses for the commercial application of aerospace research. Business Technology Center : private for-profit business incubator with many local affiliates including Caltech and the Jet Propulsion Laboratories
Educating the Public	Networking events, seminars, and workshops including: Caltech/MIT Forum : Through monthly programs, the Forum provides advice, support, education and networking opportunities to technology-based ventures in the Southern California area. Caltech Industrial Relations Center : an initiative for industry people to engage and learn how to apply technology in their industry positions.
Collaborating with Mentors and Business People	Initiatives that aim to connect entrepreneurs with individuals that can support entrepreneurial development including: CONNECT as sponsored by Caltech, Nitro an Entretec initiative.
Educating Students	Caltech Entrepreneurship Club : the Caltech entrepreneurship club is the hub for innovators in the Caltech community who want to learn how to make their idea a reality. Caltech provides courses in "Entrepreneurial Development" including a course for the development of a business plan.
Intellectual Property	
Ownership policies	Caltech retains the ownership of IP generated in university research projects.
Standard IP agreements	Policies seem to be transparent and agreements are somewhat standard.
Flexibility to Negotiate Regarding IP Ownership	Caltech will always retain ownership for educational purposes but have flexibility to allow the industry sponsor an exclusive use of the IP.
Entrepreneurial Finances	
Source, Type, and Stage of Financing	The Office of Technology Transfer provides \$30,000 to \$50,000 grants to investigate commercialization feasibility, Networking to local and private financing sources through Entretec and Office of Technology Transfer
Support for Financial Modeling	Support networking to mentors and business people as listed above.
Principle Sponsor of Center	Entretec receives financing from business sponsors, individual donors, and municipal support.
Stage Gate and Management	
Explicit Monitoring of Industry Academic Working Relationships	No explicit monitoring of industry and academic working relations.
Specific Stages and Gate Through Commercialization	The office of Technology Transfer list some steps in commercialization including: write a business plan or executive summary, negotiate IP, and complete a licensing agreement with Caltech but no seemingly transparent strategy exist.

The information described in Table 22 was taken from the MIT university website and related links including: <http://www.caltech.edu/>, <http://researchadministration.caltech.edu/osr>, <http://www.jpl.nasa.gov/>, <http://www.entrectech.org/>, <http://www3.lacdc.org/CDCWebsite/LABTC/home.aspx> and <http://www.ott.caltech.edu/>.

Table 23 describes the areas that SFU uses to promote university commercialization and entrepreneurship.

Table 22: Commercialization and Entrepreneurship at SFU

Simon Fraser University	
Participation of Academics & Lab Facilities	
Participation of Students and Faculty	Faculty are encouraged to participate in sponsored research through grant and contract work. The Fraser Valley Technology Network helps to connect University research and expertise to assist government, industry and community initiatives. The University Industrial Liaisons Officer (UILO) takes a strong role in linking researchers with industry through many methods of engagement.
Incentive for Participation	SFU promotes academic engagement with industry and entrepreneurial projects and this is evidenced by some SFU initiatives such as Fraser Valley Technology Network & Venture Connection that promote faculty participation in industry and entrepreneurial projects. Faculty first priority seems to be with research and education.
Management of COI and COC	Policies for self regulated disclosure of outside interest. The University has an explicit disclosure policy.
Use of Laboratory Facilities	Standard contractual policies to govern sponsored use of lab space and standard rates with overhead apply to cover university costs. However, these may be reduced for the sponsor through equity-holding or revenue sharing agreements for the University, or intangible benefits such as increased community profile.
Networks and Community	
Surrounding Centers and Community Supporters	TIME Venture is a business incubator partnership between SFU and BC's technology ventures industry that aims to enhance access to technology transfer services for a broad range of businesses and SFU researchers. Fraser Valley Technology Network is operated by the UILO and engages government, industry, and educational institutions to promote technology and innovation in the Fraser valley community.
Educating the Public	Venture Connection and TIME Ventures both provide educational seminars for small and medium sized enterprise. Vancouver Enterprise Forum host monthly meetings that provide networking and support for many start-up companies by linking early-stage investors and mentors to promising technology ventures.
Collaborating with Mentors and Business People	Venture Connections, Technology Business Mentorship Program through SFU and the UILO, SME Think Tank through Venture Connections, Vancouver Angel Technology Network a network of investors and mentors. All these initiatives provide entrepreneurial mentorship in the region.
Educating Students	SIFE is a student organization that encourages students to develop social entrepreneurial projects and gain entrepreneurial skills. Several entrepreneurial courses within SFU curriculum.
Intellectual Property	
Ownership policies	Simon Fraser reserves the rights to any IP that is generated in University research projects.
Standard IP agreements	There is a standard licensing agreement with indications of transparency regarding the policies.
Flexibility to Negotiate Regarding IP Ownership	Yes, the industry-sponsor can negotiate to retain ownership of IP
Entrepreneurial Finances	
Source, Type, and Stage of Financing	Various Federal Government Grants, Network to VCs and Angel Investors through the community network business incubators, Vancouver Angel Technology Network is a TIME Ventures initiative to network start-up businesses with investors.
Support for Financial Modeling	Financial modeling can be supported through the educational and mentorship initiative listed above.
Principle Sponsor of Center	Centers seem to be sponsored by a mix of educational, government, and private funding.
Stage Gate and Management	
Explicit Monitoring of Industry Academic Working Relationships	It seems the Entrepreneur in Residence Program coordinated by the UILO can help monitor entrepreneurial projects but no explicit process can be identified. Contractual agreements between university and sponsor also help to manage these projects.
Specific Stages and Gate Through Commercialization	UILO Defines a 6 step commercialization process including: 1) Identification of Commercialization Options, 2) Business Opportunity Analysis, 3) Preparation of a Commercialization Plan, 4) Dealing with the University, 5) Preparation of the Business Plan, 6) Launching Company Activities

The information described in Table 23 was taken from the SFU university website and related links including: <http://www.fvtn.sfu.ca/>, <http://www.sfu.ca/>, <http://www.sfu.ca/uilo/>, <http://www.sfu.ca/uilo/timecentre.html>, <http://www.sfu.ca/uilo/ventureconnection.html>, and <http://www.sfu.ca/ors/>.

Table 24 describes the areas that UBC uses to promote university commercialization and entrepreneurship.

Table 23: Commercialization and Entrepreneurship at UBC

UBC Practices	
Participation of Academics & Lab Facilities	
Participation of Students and Faculty	The UBC University Industrial Liaisons Office (UILO) term many agreements that can be used including: Technology Transfer, Sponsored Research, Grants, Contracts and Consulting, Engineer-in-Residence Program, Facilities and Equipment, Faculty Presentations, Faculty Visits, Graduate Student Partnership Program.
Incentive for Participation	Faculty are encouraged to engage in non-university research however this must be done within interests of the university and with professional standards. Faculty can engage in non-university research for up to 52 days per year before seeking further approval.
Management of COI and COC	Faculty are expected to be aware of the formal policy of COI and COC at UBC and must disclose any research projects that may infringe on policy.
Use of Laboratory Facilities	Joint research projects can be undertaken funded through the university and government grants to use laboratories but IP will remain with the University. Sponsored research can also be undertaken where the industry-sponsor retains IP ownership but laboratory services are expensed to the industry-sponsor.
Networks and Community	
Surrounding Centers and Community Supporters	UBC Research Enterprise a private business incubator that is owned by UBC and operated by UILO. The Centre for Drug Research and Development, Prostate Centre's Translational Research Initiative for Accelerated Discovery and Development (PC-TRIADD), and the Centre for Prevention of Organ Failure (CPOF) are centres and organizations that focus to apply academic research to become commercialized for patient care.
Educating the Public	Various workshops and networking events and conferences at UBC, Flintbox developed by UBC for industry to connect with academics regarding research discoveries and commercial opportunities, Various community engagement events through Entrepreneurship@UBC with an aim to inspire, support, and develop entrepreneurship across the campus, bringing together the many different pockets of entrepreneurial activity under one umbrella.
Collaborating with Mentors and Business People	Entrepreneurship@UBC globally connected mentorship program. UBC Research Enterprise provides some mentorship services.
Educating Students	Entrepreneurship@UBC through the Faculty of Applied Science and the Sauder School of Business have a variety of entrepreneurial oriented courses. Numerous student groups that promote entrepreneurial learning including Vancouver Students Entrepreneurship Association, MBA Society Entrepreneurship Club, and Venture Capital and Private Equity Club. Several business plan competitions.
Intellectual Property	
Ownership policies	UBC retains ownership of IP from discoveries in research unless otherwise specified.
Standard IP agreements	Yes there are standard and transparent agreements.
Flexibility to Negotiate Regarding IP Ownership	There is flexibility for sponsor to retain ownership of IP.
Entrepreneurial Finances	
Source, Type, and Stage of Financing	Grants through Entrepreneurship@UBC, Government grants through IRAP, Many programs network to private investors.
Support for Financial Modeling	Some financial modeling assistance is available through the education and mentoring initiatives listed above.
Principle Sponsor of Center	UBC Research Enterprise is funded by UBC. Government also plays a major role in funding the centers (CPOF and TRIADD).
Stage Gate and Management	
Explicit Monitoring of Industry Academic Working Relationships	Industry sponsored agreements cover many details of working relationships and help with management but no explicit monitoring system is used.
Specific Stages and Gate Through Commercialization	Screening processes are used to enter Research Enterprise and to receive funding from Entrepreneurship@UBC.

The information described in Table 24 was taken from the UBC university website and related links including: <http://www.ubc.ca/>, <http://www.uilo.ubc.ca>, <http://www.ors.ubc.ca/>, <http://www.pctriadd.com/>, and <http://www.proof.icapture.ubc.ca/>.

Table 25 describes the areas that U of W uses to promote university commercialization and entrepreneurship.

Table 24: Commercialization and Entrepreneurship at U of W

U of W Practices	
Participation of Academics & Lab Facilities	
Participation of Students and Faculty	Conrad Centre for Business, Entrepreneurship and Technology (CBET) has programs to connect students to real world entrepreneurial project within the Entrepreneur in Training Program. Waterloo Engineering Research office assists researcher to be successful in acquiring funding, writing proposals, and developing partnerships for all research including entrepreneurial opportunities.
Incentive for Participation	Motivated by inventor retained IP in all scenarios. The University acknowledges a commitment, as part of its overall mandate, to transfer knowledge, discoveries and technology to society for its benefit.
Management of COI and COC	Outside collaboration with industry is encouraged as long as high ethical and professional standards are upheld. Employees are to disclose any outside situations that could impose a conflict of commitment or interest.
Use of Laboratory Facilities	Many sponsored research projects require the industry sponsor to cover the cost of facilities and services.
Networks and Community	
Surrounding Centers and Community Supporters	The Accelerator Center (AC) is a business incubator located on Waterloo Campus as key part of Research Park and also has networks to other business incubators of the surrounding region including: Communitech, Ontario Centers of Excellence, Waterloo Municipality, Medical and Related Science (MaRS), Ministry of Research and Innovation
Educating the Public	Media marketing through AC. AC works with U of W and other regional educational institutions to provide education to client entrepreneurs through workshops, lunch and learns, client and CEO roundtable sessions and other training programs.
Collaborating with Mentors and Business People	CBET has educational programs with industry and academics for entrepreneurial collaborations. AC provides mentorship programs to connect their clients with entrepreneurial experts.
Educating Students	CBET offers Master of Business, Entrepreneurship and Technology (MBET) that is a degree that aims to produce MBA graduates who are set apart from their colleagues in general business programs by emphasizing technological, innovative and entrepreneurial energies.
Intellectual Property	
Ownership policies	Ownership remains with the author or creator or researcher.
Standard IP agreements	Yes, but only if there is a sponsored research agreement.
Flexibility to Negotiate Regarding IP Ownership	Yes, in sponsored research, the sponsor can reserve some ownership rights of the IP created within the research project.
Entrepreneurial Finances	
Source, Type, and Stage of Financing	No direct funding through AC but do seem to provide assistance to access all types of capital through networking. There is potential funding through the CBET business plan competition. Waterloo Commercialization Office has networks to potential funding. Government offer some funding opportunities.
Support for Financial Modeling	AC services can support financial modeling. CBET collaborations with industry can connect students to financial projects.
Principle Sponsor of Center	AC was primarily funded by various government organizations and the U of W.
Stage Gate and Management	
Explicit Monitoring of Industry Academic Working Relationships	Sponsored agreements cover many details of working relationships but no explicit monitoring system is used.
Specific Stages and Gate Through Commercialization	No explicit commercialization process. Entry into AC is screened by a proposal accompanied commercialization schedule and subsequently continued with monitoring of businesses progress.

The information described in Table 25 was taken from the U of W university website and related links including: <http://uwaterloo.ca/>,
http://www.research.uwaterloo.ca/watco/uw_researchers_funding_i2i.asp,
<http://www.research.uwaterloo.ca/>, and <http://www.acceleratorcentre.com/>.

Table 26 describes the areas that UCSD uses to promote university commercialization and entrepreneurship.

Table 25: Commercialization and Entrepreneurship at UCSD

UCSD Practices	
Participation of Academics & Lab Facilities	
Participation of Students and Faculty	Faculty and students are encouraged to be involved in entrepreneurial projects through the UCSD Jacobs Engineering School. Type of research engagements include: gifts and endowments, Industrial affiliate and membership programs, Contracts for specific research projects, Transfer of materials for research projects, Use of unique UCSD equipment and specialized facilities on a fee-for-service basis, Outside consulting Agreements between companies and UCSD faculty, Confidentiality agreements for exchange of information in anticipation of funded project.
Incentive for Participation	Students and faculty are encouraged to become part of entrepreneurial endeavors and consult for fees and take equity in start-ups. However, research must always remain within UCSD code of ethics and avoid COI and COC.
Management of COI and COC	Policies enforce disclosure of any non-government sponsored research projects. Principal investigators cannot hold a large equity position while being at UCSD but can still assist with the research.
Use of Laboratory Facilities	Facilities and labs may be used in sponsored-projects at the cost of the industry- sponsor only if those facilities cannot be reasonably accessed elsewhere. University will charge break-even cost for the laboratory facilities.
Networks and Community	
Surrounding Centers and Community Supporters	Von Liebig Centre is a non-profit business incubator affiliated with the Jacobs School of Engineering. San Diego Technology Incubator is a private business incubator that supports the economic development of the region by sheltering and supporting new technology ventures. CONNECT is affiliated to UCSD and an organization with a mission to help commercialize research discoveries through education, mentoring and access to capital.
Educating the Public	San Diego MIT Enterprise Forum with a purpose to education, network, and engage the community among business leaders, technologists, capital and service providers. Events through the UCSD Connect networking platform. The Corporate Affiliates Program (CAP) is the primary means by which the Jacobs School cultivates relationships with industry. Von Liebig Speaker Series a series of seminars with entrepreneurial topics.
Collaborating with Mentors and Business People	The Von Liebig Center provides networking to mentors as a commercialization assistance service for researchers. CONNECT provides mentorship services to entrepreneurs.
Educating Students	Von Liebig Center offers a series of entrepreneurial courses for students.
Intellectual Property	
Ownership policies	UCSD retains ownership of IP in university research projects.
Standard IP agreements	There seems to be transparency in the policies related to IP and sponsored research.
Flexibility to Negotiate Regarding IP Ownership	There is flexibility in the agreements to negotiate regarding equity and royalty licenses, but IP ownership will remain with University.
Entrepreneurial Finances	
Source, Type, and Stage of Financing	UC Discovery Grants offered to UC campuses to support research with an industry-sponsor, Von Liebig Proof of Concept Grants - offered for early stage seed funding to help bring a technology closer to commercialization. CONNECTS networks to private financiers.
Support for Financial Modeling	Available through advisory services as listed above with in entrepreneurial education and mentorship.
Principle Sponsor of Center	The Von Liebig Centre was funded by a philanthropic donation. CONNECTS was financed through municipal, university, and private sources. San Diego Technology Incubator was financed through municipal and surrounding colleges.
Stage Gate and Management	
Explicit Monitoring of Industry Academic Working Relationships	Many policies and procedure within sponsorship agreements to support management but explicit on-going monitoring it used.
Specific Stages and Gate Through Commercialization	Screening is used through a proposal application of the business case for the Von Liebig Centre. No explicit commercialization process is evident.

The information described in Table 26 was taken from the UCSD and related links including:

<http://www.ucsd.edu/>, <http://www.vonliebig.ucsd.edu/>, <http://www.connect.org/>, <http://www.sdincubator.org/>, and <http://invent.ucsd.edu/index.shtml>.

Appendix B: Eneray Sustainable Structures Business Notes

A business plan was completed for Eneray Sustainable Structures to demonstrate commercial feasibility and a strategy for start-up. For preliminary feasibility, Figure 26 is a summary of a New Venture Template (NVT) assessment for the Eneray business idea.

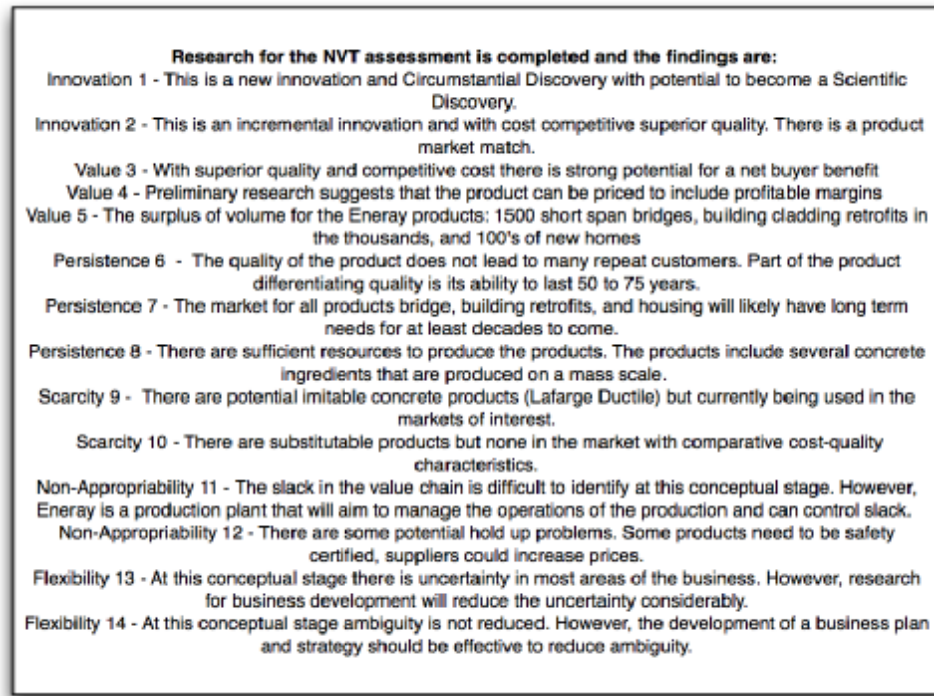


Figure 25: Eneray NVT Assessment

The NVT summary assesses the business idea on six criteria of innovation, value, persistence, scarcity, protection, and flexibility. The result of the NVT assessment indicates no major barriers to commercialization and potential to create value through the creation of a new business.

After feasibility a business plan was completed and a very detailed financial analysis was completed to assess the current value of the Eneray business idea. Figure 27 is a schedule excerpt from the business plan that summarizes the financial value of the Eneray venture.

<u>Schedule 12: Investment Analysis</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>
Required Return on Equity	30%				
<u>Present Value of Equity Investment</u>					
Equity Investment	500,000	-	-	-	-
Present Value of Equity Investment	500,000	-	-	-	-
<u>Present Value of Equity Returns</u>					
Net Cash Flows to Equity	161,671	647,558	(662,430)	1,462,226	2,314,947
Dividends	-	-	-	-	-
Salvage Value	-	-	-	-	9,259,788
Total Net Cash Flow to Equity	161,671	647,558	(662,430)	1,462,226	11,574,735
Present Value of Net Cash Flows	3,835,396				
Total Cash Flows to Equity	(338,329)	647,558	(662,430)	1,462,226	11,574,735
Net Present Value of Equity Investment	3,335,396				
Internal Rate of Return on Equity Investment	89%				

Figure 26: Eneray Valuation

The financial analysis was a component to the business plan that included assessment of the Eneray business model, products, market, operations, legal considerations, exit strategy, and more. A summary of the Eneray business plan is described below in an excerpted executive summary.

Eneray Sustainable Structures

The business strategy of Eneray is to manufacture modular precast concrete units for two products: short-span bridges and exterior building envelope panels. The units will be manufactured in shop and subsequently provided for designated sub contractors to implement for infrastructure projects. Eneray is projected to sell 40,000 ft² of building Retro Panels and secure 2 bridge contracts in year one. First year net income is projected to be \$206,000 with a net profit margin of 14%. Since the creation of the business concepts 8 months ago, Eneray technology has experienced a significant market pull. Eneray has been invited to bid on six short span bridges to be completed within the year, is in production for one building contract for the Retro Panel, and have another building owner very interested implementing the Retro Panel product – all strong indications that this first year sales forecast can be achieved. Assuming that 2 bridge contracts can be secured, only 22,075 ft² of the forecasted 40,000 ft² retro panels need to be sold to breakeven on net income. Financial projection 5 years into the future forecasts a 3.3M NPV with a 30% discount rate as well as a 89% IRR.

In the current global environment, there is a strong push to remain environmentally sustainable while reducing capital costs and increasing life cycle savings. Organizations are building, purchasing, and occupying infrastructure with the expectation of a long service life. However, infrastructure owners/managers are losing life-cycle value due to inefficient construction methods. Eneray presents solutions to infrastructure inefficiencies with innovative technologies applied in a precast concrete manufacturing plant located in Saskatchewan.

Eneray technologies address cost efficiency and quality in the construction of short span bridges as well as building envelope retrofits. The product solution uses High Performance Fiber Reinforced Concrete with Expanded Polystyrene for thermal insulation in an optimal design to produce light-weight and extremely high quality precast infrastructure. The inherent properties of the concrete material give superior environmental durability, aesthetic quality, and significant strength to weight ratio. The product designs will deliver a long life at a competitive or reduced capital cost relative to alternatives and thus a far superior life cycle cost. The innovative designs will be protected with various forms of intellectual property that are currently under investigation.

The Eneray business will be sustained with growth in the current products as well as into new and future markets. The current product markets indicate growth in capacity through customer demand and plans for future work. A vision for economic attractiveness within the new markets such as energy efficient prefab housing exists. Finally growth in revenues through licensing Eneray technologies is strategized in the business model.

Manufacturing the panels and bridges in the first three years of operations will occur in a leased facility, with plans for a \$5.2 million building expansion in 2012 to fulfill projected demand. Approximately \$600,000 in equity and debt will be needed to fund the initial startup phase, with an additional \$3,800,000 in debt needed for the additional precast manufacturing plant in 2012.

The Eneray team has significant experience with infrastructure as two of the founding members have over 40 years combined experience in the industry. The team also consists of a mechanical engineer, a civil engineer, and a graduate of finance all from the University of Saskatchewan. Eneray has made other strategic partnerships to increase the speed to market with institutions and businesses such as Tricon Precast Ltd. (bridge technology), Springboard West Innovations (business strategy), and the U of S College of Engineering (research and development). These partnerships are enabling Eneray to maximize the available resources and become the leading provider for environmentally sustainable structures.

Appendix C: Case Study Stakeholder Feedback

Several individuals and groups are conceptually involved in the illustrative case study to commercialize the Eneray business idea. Stakeholders are identified to represent these individuals and groups and asked for feedback regarding their conceptual willingness to participate as well as to identify any strengths, weaknesses, opportunities, or threats regarding their conceptual involvement. The stakeholders include: a Ph.D. Student, an M.Sc. Student, an Undergraduate Student, an Engineering Faculty member, a Law Faculty, an Industry Entrepreneurs, an EEC Advisor, an Industry Expert, an Entrepreneurial Mentor, an Entrepreneurial Financier, an Industrial Liaisons Officer, a Private Financier, the Dean of Engineering, and Government Sponsors. Feedback from these stakeholders regarding participation is an indication of the potential value and the feasibility for commercialization model and EEC. in addition to indication for incremental improvements for future commercialization. The following exerts are feedback given by each of the representative stakeholders.

Feedback from the Ph.D. Student:

1. This is really a great idea. I will participate in this program from my intent. But it really depends on how much time I will put on, because I am really busy doing my research and taking care of my baby. The only concern is the potential time constraints.
2. Because I am doing the research on Ultra High Performance Concrete, which Eneray is very interested in, I can receive a good sense of how the result and my research can impact industry. Since I do not have enough business database or information, I'm not capable to give very good business evaluations for this project. I believe this commercialization project would be a great opportunity for me considering the future good cooperation and the potential profits that could be obtained. I think hard work, good results, and close communication communicate with the College and Eneray would be key to success in this project.

Feedback from the M.Sc. Student/Project Champion/Student Entrepreneur:

1. I think it is very likely that I would have participated in a program like this had it been an option. Not only do you gain practical experience in business planning, students potentially get a share of the new business and industry contacts. I think it would be a great learning experience, even if the business turns out to be unsuccessful.
2. SWOT Analysis:
 - a. Strengths
 - i. As a student project champion, I would gain practical entrepreneurship experience, likely within my chosen field.

b. Weaknesses

i. The EEC seems to rely on many databases to identify appropriate students, faculty, and industrial liaisons when required. How are these maintained, and how do you ensure the information is accurate? If you require someone to fill a position, but are unable to identify someone through the databases, what next?

ii. Are there potential conflicts of interest when faculty are involved? I'm not sure what the University or professional codes of conduct say about consulting and teaching, but I'm sure that conflicts could arise. How would the EEC address them?

iii. Would the University be willing to give lab space and other resources when it is to be used for private commercial research? I guess research would likely be taking place in the context of a class or graduate research, so that might not be a problem.

c. Opportunities

i. I think this process would be a great EEO capstone project, rather than the current business planning/marketing research combination. After taking several introductory business classes, and some intermediate entrepreneurship and business planning classes, EEO students would get a lot of educational value in using their new skills in creating an actual business. In particular, having the student only handle the planning, and relying on the business venture to finance the business would give EEO students the chance to be involved in much larger businesses than they might otherwise be able to.

ii. There are other entrepreneurship courses on campus, any one of which might be interested in participating in your project. Agriculture in particular might have students who would be interested in this.

d. Threats

i. If business teams don't approach the EEC to help plan their business, what happens? Does the ECC have its own idea generation abilities, or is it reliant on outside sources?

That's about all I've got. In short, it sounds like a really great idea, and I hope that you're able to move forward with it. I think it would be really beneficial to all parties involved, and students would definitely get a lot out of it.

Feedback from the Undergraduate Student:

1. What is the likelihood that you would participate in a program such as this if the opportunity presented itself? If you would not, why?

Answer: I would most definitely participate in a program like this; especially if I could use the business plan for Comm 447. My only concern would be the extra time and effort put in if I

couldn't use the business plan for a class. The issue being simply the large course requirements for Engineering students in their final years. As a mechanical student taking the EEO, if I had attempted to follow the 4 year plan I would be taking 7 or 8 classes a term. However, if the team working on the business plan were large enough and the time requirements reasonable, I'm sure I would not have a problem fitting it in. Engineering students are notorious for finding time to do all sorts of extracurricular activities outside of their courses.

As a student enrolled in the EEO I have a strong interest in business and an opportunity like this would be very appealing to me. I think the potential learning opportunities this program affords through the training courses and practical experience of the people who I would be working with is also an attractive selling point.

2. Can you identify any strengths, weaknesses, opportunities, or threats related specifically to your conceptual involvement with the program?

Answer:

- *Strength – By having undergrads work on these plans this center may also provide employment opportunities for us and valuable employees for clients.*
- *Weakness – I think it would be beneficial to utilize students outside of engineering as well, specifically ESB students.*
- *Strength – The I3 Challenge is great incentive for students to join this program, could also look into other competitions or perhaps contribute to I3 once established.*
- *Opportunity – To build database of students, you could approach the entrepreneurship classes and clubs (ACE, Could make participation the requirement for GE430(EEO Capstone), Comm349 and 447, there's also an Ag business plan class)*
- *The more cash potential for students the more dedication to the project you will get. Depending on the project, a partial equity share amongst the entire planning group or maybe a consulting fee based on the quality of the plan or success of the business might help.*
- *Depending on the product or business you might be able to incorporate part of the plan into the final engineering design projects.*
- *I think it would be necessary to promote the EEC through networking events, emails and class talks similar to what the Wilson Center does. Although many engineering graduates end up either owning or running businesses, I think very few leave university with that as a goal and I think this center/program could present that option to students.*

The engineering program at U of S has commerce class first year that outlines the basics of business however I think it would be beneficial to have an entrepreneurship class as part of the curriculum in the final year to promote entrepreneurship as a career option for engineers. This class could utilize guest speakers and possibly case studies provided by the EEC and potentially add many more students to your database.

Feedback from the Engineering Faculty:

Yes, I would participate.

Currently, there is a lack of a strong interface between university and industry. On the one hand, a lot of work is being done by many faculty members in the engineering college without necessarily giving Canadian companies any special industrial and/or economic benefit. The research is typically sponsored by government funding agencies and the results published in peer-reviewed international journals and that is the end. On the other hand, many companies either do not have their own R&D departments or simply do not have some aspect of expertise needed to successfully develop innovative products, and hence can dramatically benefit from interacting with the university by having access to the unique knowledge, expertise, and educational resources available at Canadian postsecondary institutions and to train students in essential technical skills required by industry. The proposed role of the EEC would certainly help facilitate such mutually beneficial collaborations which could potentially lead to industrial and/or economic benefits to Canada.

Although, both university and industry seem to be convinced that they can achieve much more through collaboration than they can achieve individually (synergetic use of resources, larger pool of government funds, etc.) such interactions seem to remain around minimum levels. I think there is a lot of room for improvement in this regard. Oftentimes, faculty members feel like industry is not taking full advantage of what they can offer through the university in terms of R&D potential, and they would be thrilled to see that the innovative ideas they have been publishing in the various scientific venues are actually being implemented and benefitting the Canadian industry. But they do not find it easy to approach industrial partners (lack of time, lack of knowledge of who they should talk to, etc.)

I think a number of hurdles are still on the way and it is hoped that the establishment of the EEC would help eliminating some of them by serving as an interface between industry and the university. It is a fact that most faculty are not working closely enough with industrial partners to know of their particular problems and offer their help to solve many of the problems they may be facing. On the other hand, many companies are also not even aware of what the university is doing and how it can help them with their R&D projects.

A particular hurdle that often seems to show up with those industrial partners who are aware of what the university can do for them is the issue Intellectual Property (“IP”) rights. Typically, University faculty members assign IP rights to the University on appointment. For grants, any Intellectual Property (“IP”) rights remain with the University. In a contract however, the University Industry Liaison Office can negotiate stand-alone IP agreements with the sponsor. This possibility to negotiate stand-alone IP agreements does offer some flexibility but many of the industrial partners still seem not to be very comfortable with it. I do not know what would be the best way to deal with this issue but your proposed model seems to offer a viable alternative that needs to be considered by all parties involved in a project.

Feedback from the Law Faculty:

1. No I would not participate in this type of project. I do not recommend the participation of faculty from the college of law because these are business contracts that involve the exchange of value and can, in some cases, end up in litigation. Most faculty of the

College of Law do not have liability insurance to protect themselves if the parties involved end up in litigation.

2. Would recommend using a legal consultant for industry instead of using the faculty from the College of Law in the formalization of the working agreements.

Feedback from the Industry Entrepreneur:

Having been involved with several startups over the years I recognize the need for effective teamwork focused on achieving aggressive goals. Although there are a number of resources and organizations available to assist startups, the template you laid out is uniquely a Saskatchewan approach with strong technical support. I don't have a lot of negative comments to offer as I see a good framework that should lead to good business development. For new or first time entrepreneurs you could add in some evaluation of their core competencies, strengths and weaknesses to determine the level of support they would need and to determine their roles in the company both present and future. Where one fits in the mix is the scariest thing to address for a founder but is essential for successful business development. Key players, governance and the core purpose of the business are essential concepts that must be addressed. For example, if they are building to sell, then your strategy is completely different than one that is building towards a legacy company. I am not sure how you incorporate this into your template.

On another note, you may want to include other Saskatchewan resources for assistance. For example, STEP can do a lot of free market research and can fund research and promotional trips as well as fund receivables for out of province customers.

Overall you did a great job and I think it is a valuable vehicle to help people with an idea turn it into a profitable and successful reality.

Feedback from the EEC Board Member:

1. Yes I would participate and like the idea
2.
 - a. Networking Events – needs structure to generate ideas. Maybe presentation by the guest for market problems or presentation for projected trends in industry
 - b. The EEC Student Database will need to be monitored constantly and updated constantly because of turnover. Maybe a membership idea with some value for participating would be good for incentives.
 - c. Are there any deterrents from students participating because of conflicting graduation schedules.
 - d. It would be good to include feeder courses and programs to collaboratively work with the commercialization model.
 - e. There is a caution that sometimes students cannot receive payment for course projects.
 - f. The percentage of equity may be on the low end of what the EEC should take

Feedback from the Industry Specialist:

1. Yes, I would participate if the opportunity presented itself. I often participate in this a role such as this and the only time I would not participate is if the project were not related to my industry.

2. There may be a weakness in assessing the technical feasibility of the idea. The model could use more assessment of the technical feasibility of the idea.

Ongoing communication of the incubatee and the entrepreneurial team may be key to success.

Recruiting an effective project champion will be key to the success of the project.

Feedback from the Entrepreneurial Mentor:

- . 1) Yes, I would participate in this mentorship role. The only stipulation is that the relationship and fit must be right for mentorship.
- 2) Your model suggests that the project champion (as well as the EEC?) will receive some amount of equity for his/her/their involvement of the project – After some thought about this it seems to me that providing equity to anyone/organization who is not going to be a key contributor (to the ongoing business organization) over the longer term (i.e. beyond the project timeline) may be a flaw in the business model. Most business owners will be loath to give up equity to a person/group who is not contributing to the long term success of the organization. As I mentioned in our meeting the better way to compensate is through share option grants; the provision of which are tied to milestones that a person/group must achieve over a future time horizon to ensure that there is value driven back to the organization over the longer term. If for whatever reason the person/group cease to be a contributing member of the business entity (i.e. milestones are not achieved) then their share option grants are deemed void and not exercisable resulting in no further dilution to the business entity – this make more sense for all participants. In my view value-added services (in exchange for equity) must be proven throughout the business entity's life not just in the early stages.

Feedback from the Entrepreneurial Financier:

I would conceptually participate and think the EEC could be an excellent tool for developing technology businesses to be ready for start-up financing. As a VC would see being part of the financiers network as an opportunity.

Would be very reluctant to invest if the university owned the IP. If the university owns the IP, I would need confidence that the university execute a reasonable license and not burden the commercialization focus. Complete confidence is not currently there.

An important component of financing is the fit between business and financier and this would be a decisive factor for financing the business.

The valuation of the business is often a problem in financier start-ups. There could be more opportunity to develop a business valuation in the commercialization model. A reasonable valuation would be a benefit to a successful financing negotiation.

Feedback from the Private Financier Venture Capitalist:

This could be a great financing opportunity for the right private investor. Not only for a return on investment but a screening and due diligence tool before actually making investments in the start-ups. If I were running a VC firm I would consider the \$2.3 million investment as part of my R&D budget. In this way the investment would be considered an expense but still has potential to return some decent profits. In Saskatchewan Golden Opportunities or Saskatchewan Works Investment firms may be a good fit to finance the EEC.

It is important to keep the EEC as a private and separate firm from the university in effort to stay away from bureaucracy and burdensome university policy.

The salaries of the EEC employees could be reduced in effort to reduce the expense of the EEC. An alternative structure for compensation like stock options may be an opportunity.

Feedback from the Industrial Liaisons Officer:

In the context of research projects that are brought to the university from industry-sponsors with a goal to use the research findings for commercial purposes, there is no documented standard types of agreements for the U of S but there are policies that guide the development the formulation of fairly standard agreements that can be completed within an amount of time dependent on the complexity of the technology and the situation as well as the dynamics of the people negotiating. The policies that U of S follow are similar to those listed with the following link <<http://www.lesusacanada.org/StandardPatent>>.

Scenario 1 of the commercialization model, the industry sponsor brings a research project to the university but does not cover the cost of the research. These projects can sometimes take the path of a normal MSc. or Ph.D. project. It is usually the case that outside research funding can be integrated to cover the cost of research and this can alter the negotiation. Anything is negotiable of course it depends what else the industry-sponsor brings to the table. Maybe the industry partner can negotiate the rights to the IP, it's good to have an industry partner involved, they may be the ones to transfer the knowledge to usefulness. However, the university cannot afford to do things for free.

Scenario 2 of the commercialization model, the industry-sponsor brings a research project to the university and covers the cost of the research (no original IP belongs to sponsor). At this early stage before the research starts, negotiating an agreement for future use of IP that is undefined is difficult to develop and very time consuming. Instead the IP ownership of any potential new discoveries will remain with the university as they are discovered by university faculty and then potentially negotiated for a license to the industry-sponsor at a later date once the IP is defined and there is an understanding of what is being negotiated. Although it is difficult, there is some opportunity to reach an agreement at the pre-research stage to negotiate a license for commercial use of the IP but there would need to be compensation given by the industry-sponsor.

Feedback from the Dean of Engineering:

Yes, this addresses a need for the College of Engineering and fits with the goals of the College.

SWOT

The investment opportunity and design is interesting and there may be an opportunity to play a role perhaps as a public private partnership

The database of students is a good strength and perhaps there can be a membership to participate

There is a potential threat if the incentives are not addressed. Faculty may be a tough sell.

There is a potential opportunity to be linked with other research institutions like (U of R), (U of A), NRC.

Feedback from the Government Sponsors:

The provincial and federal government programs do not fund for-profit businesses and this would be a road block in government funding of the currently structured for-profit EEC.

There are potential issues surrounding the management of intellectual property in the university environment. The current IP management policies and the university ownership policies may restrict some industry sponsors from participating and may be a weakness for the commercialization model and the EEC.

There are many organizations that support commercialization. It is important to differentiate the EEC and to clearly illustrate the partnerships and affiliations that EEC might have. A number of organizations were mentioned: springboard west, Ideas Inc., IRAP, and TRILabs.

There may be potential to have an alumni fund to support such a center at the U of S.

I've been pondering since the meeting is whether there is an avenue to pursue through the co-op program. Is it possible for the ENG 495 students to do a co-op term in entrepreneurship, trying to make a business out of their ideas, but somehow supported by other entrepreneurs in the community?

I believe you may still find yourselves to be somewhat at odds with the policies of the University in general. So long as this remains a project involving the College of Engineering, you will still to a large extent be governed by the University's policies with respect to IP.

I think the only thing I would add to the below is that further discussions would be needed within the University environment to determine that this is, in fact, something that the University overall would like to support (in their overall strategy). We would not want to consider funding/developing a project that did not have support from the highest levels of the university and where it had been determined to be one of the universities priorities in terms of funding.

Appendix D: Financial Notes for the EEC

The Engineering Entrepreneurship Centre (EEC) is a for profit private business incubator that is projected to be financially profitable. To demonstrate financial sustainability, the expenses of the EEC are considered. The expenses include salaries, legal, accounting, marketing, travel & tradeshow, phone and internet, rent and utilities, office equipment, and incubatee client investments. Table 27 and 28 describe the expenses that are forecast by the EEC over the first fifteen years.

Table 26: EEC Expenses Years 1 - 7

Expenses	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Salaries							
Administration Assistant	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00
Incubation Manager	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00
EEC Director	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00
Employee Benefits	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00
Number of Clients	1	2	4	8	10	10	10
Legal	\$8,000.00	\$11,000.00	\$17,000.00	\$29,000.00	\$35,000.00	\$35,000.00	\$35,000.00
Accounting	\$10,000.00	\$12,000.00	\$16,000.00	\$24,000.00	\$28,000.00	\$28,000.00	\$28,000.00
Marketing	\$21,000.00	\$22,000.00	\$24,000.00	\$28,000.00	\$30,000.00	\$30,000.00	\$30,000.00
Travel & Tradeshow	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00
Phone and Internet	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00
Rent & Utilities	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00
Office Equipment	\$6,950.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00
Client Investments	\$25,000.00	\$50,000.00	\$100,000.00	\$200,000.00	\$250,000.00	\$250,000.00	\$250,000.00
Total Expenses	\$387,650.00	\$413,700.00	\$475,700.00	\$599,700.00	\$661,700.00	\$661,700.00	\$661,700.00

Table 27: EEC Expense Years 8 – 15

Expenses	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Salaries								
Administration Assistant	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00	\$50,000.00
Incubation Manager	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00	\$80,000.00
EEC Director	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00	\$120,000.00
Employee Benefits	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00	\$32,500.00
Number of Clients	10	10	10	10	10	10	10	10
Legal	\$35,000.00	\$35,000.00	\$35,000.00	\$35,000.00	\$35,000.00	\$35,000.00	\$35,000.00	\$35,000.00
Accounting	\$28,000.00	\$28,000.00	\$28,000.00	\$28,000.00	\$28,000.00	\$28,000.00	\$28,000.00	\$28,000.00
Marketing	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00
Travel & Tradeshow	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00	\$10,000.00
Phone and Internet	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00	\$1,200.00
Rent & Utilities	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00	\$23,000.00
Office Equipment	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00	\$2,000.00
Client Investments	\$250,000.00	\$250,000.00	\$250,000.00	\$250,000.00	\$250,000.00	\$250,000.00	\$250,000.00	\$250,000.00
Total Expenses	\$661,700.00	\$661,700.00	\$661,700.00	\$661,700.00	\$661,700.00	\$661,700.00	\$661,700.00	\$661,700.00

Table 27 and 28 describe expenses that are \$387,650 in year one and modestly increase until reaching capacity in year five at \$661,700. The expenses that are used for rent of office space are described in Table 29.

Table 28: Expenses for Office Space

Rent and Utilities	
Space (sq.ft.)	1000
Operations (\$/sq.ft.)	7.5
Rent (\$/sq.ft.)	14
Utilities (\$/sq.ft.)	1.5
Monthly Cost of Office Space	23000

The rent of office space is budgeted to be \$23,000 per year.

The revenues of the EEC are also forecast to demonstrate financial sustainability of the EEC. The revenues include incubatee service fees and returns from incubatee equity investment. Table 30 and 31 describe the EEC revenues that are forecast over the first fifteen years.

Table 29: EEC Revenues Years 1 - 7

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Number of Clients	1	2	4	8	10	10	10
Incubatee Fees	\$12,000	\$24,000	\$48,000	\$96,000	\$120,000	\$120,000	\$120,000
Average Return on Investment						\$775,651	\$1,551,302
Capital Investment	\$2,300,000						
Total Revenues	\$12,000	\$24,000	\$48,000	\$96,000	\$120,000	\$895,651	\$1,671,302

Table 30: EEC Revenues Years 8 - 15

	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Number of Clients	10	10	10	10	10	10	10	10
Incubatee Fees	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000
Average Return on Investment	\$3,102,604	\$6,205,209	\$7,756,511	\$7,756,511	\$7,756,511	\$7,756,511	\$7,756,511	\$7,756,511
Capital Investment								
Total Revenues	\$3,222,604	\$6,325,209	\$7,876,511	\$7,876,511	\$7,876,511	\$7,876,511	\$7,876,511	\$7,876,511

Table 30 describe modest revenues in the first five years of operation until the revenues from equity investment begin and increase revenues from \$120,000 in year five to \$7,876,511 in year ten. Table 30 also illustrates a capital investment of \$2,300,000 that is needed to allow the EEC to remain cash positive through it's existence.

The profitability of the EEC is forecast using the expenses described in Table 27 an 28 and the revenues described in Table 30 and 31. Table 32 and 33 describes the forecast fifteen-year profitability of the EEC through the net profits and the business assumption that all profit is

accumulated in cash to equity. The net profits are taxed with at a rate of 15 percent for the first \$500,000 and 30 percent for net profit above \$500,000. A non-taxable carry forward is also used for the first years of negative cash flow for the EEC. The fifteen-year profitability of the EEC is described in Table 32 and 33.

Table 31: EEC Profitability Years 1 - 7

Profitability	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Total Revenues and Cash	\$12,000	\$24,000	\$48,000	\$96,000	\$120,000	\$895,651	\$1,671,302
Total Expenses	\$387,650	\$413,700	\$475,700	\$599,700	\$661,700	\$661,700	\$661,700
Net profit	(\$375,650)	(\$389,700)	(\$427,700)	(\$503,700)	(\$541,700)	\$233,951	\$1,009,602
Taxable benefit & carry forward	(\$375,650)	(\$765,350)	(\$1,193,050)	(\$1,696,750)	(\$2,238,450)	(\$2,004,499)	(\$994,897)
Net Profit After Tax	(\$375,650)	(\$389,700)	(\$427,700)	(\$503,700)	(\$541,700)	\$233,951	\$1,009,602
Cash to Equity	\$1,924,350	\$1,534,650	\$1,106,950	\$603,250	\$61,550	\$295,501	\$1,305,103

Table 32: EED Profitability Years 8 - 15

Profitability	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Total Revenues and Cash	\$3,222,604	\$6,325,209	\$7,876,511	\$7,876,511	\$7,876,511	\$7,876,511	\$7,876,511	\$7,876,511
Total Expenses	\$661,700	\$661,700	\$661,700	\$661,700	\$661,700	\$661,700	\$661,700	\$661,700
Net profit	\$2,560,904	\$5,663,509	\$7,214,811	\$7,214,811	\$7,214,811	\$7,214,811	\$7,214,811	\$7,214,811
Taxable benefit & carry forward	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Net Profit After Tax	\$2,166,102	\$4,039,456	\$5,125,368	\$5,125,368	\$5,125,368	\$5,125,368	\$5,125,368	\$5,125,368
Cash to Equity	\$3,471,205	\$7,510,661	\$12,636,029	\$17,761,396	\$22,886,764	\$28,012,132	\$33,137,499	\$38,262,867

Table 32 and 33 describe that the EEC will remain cash positive for the fifteen-year projection with the \$2.3 million investment. The first five years of the EEC result in a net loss of cash flow but years six through fifteen grow net profits and until cash to equity is forecast to reach over \$38 million in year fifteen.